

REGISTER
OF
LEHIGH UNIVERSITY



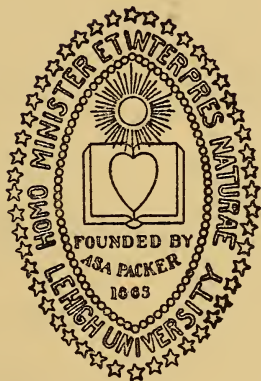
1924-1925

BETHLEHEM
PENNSYLVANIA

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REGISTER
OF
LEHIGH UNIVERSITY



1924-1925

BETHLEHEM
PENNSYLVANIA

May, 1925

1924

JULY

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JUNE

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1924-1925

Sept. 12, 13, 15, 16 (Fri., Sat., Mon., Tues.)..Examinations for admission
Sept. 15, 16, 17 (Mon., Tues., Wed.)....Registration days
Sept. 17, 3.30 p.m. (Wed.).....First term begins
Oct. 1 (Wed.).....Founder's Day
Nov. 26, 4.00 p.m. (Wed.).....Thanksgiving holidays
begin
Dec. 1, 8.00 a.m. (Mon.).....Thanksgiving holidays end
Dec. 20, 12.00 m. (Sat.).....Christmas holidays begin

Jan. 5, 8.00 a.m. (Mon.)	Christmas holidays end
Jan. 26, 8.00 a.m. (Mon.)	Examinations begin
Jan. 31, 5.00 p.m. (Sat.)	Examinations end
Feb. 3, 4 (Tues., Wed.)	Registration days
Feb. 5, 8.00 a.m. (Thurs.)	Second term begins
Feb. 23 (Mon.)	Junior Oratorical Contest
April 8, 4.00 p.m. (Wed.)	Easter holidays begin
April 13, 8.00 a.m. (Mon.)	Easter holidays end
May 25, 8.00 a.m. (Mon.)	Examinations begin
May 30, 5.00 p.m. (Sat.)	Examinations end
June 6 (Sat.)	Alumni Day
June 7 (Sun.)	Baccalaureate Sunday
June 8 (Mon.)	Class Day
June 8 (Mon.)	Summer courses in Surv., Assaying, and M.E. Lab. begin
June 9 (Tues.)	University Day
June 10, 11, 12, 13 (Wed., Thurs., Fri., Sat.)	Examinations for admission
July 4 (Sat.)	Summer courses in Surv., Assaying, and M.E. Lab. end
July 6 (Mon.)	Summer session begins
August 19 (Wed.)	Summer session ends

1925-1926

Sept. 16, 17, 18, 19 (Wed., Thurs., Fri., Sat.)	Examinations for admission
Sept. 21, 8.00 a.m.-5.00 p.m. (Mon.)	Registration, Freshmen
Sept. 22, 8.00 a.m.-12.00 m. (Tues.)	Registration, Sophomores
Sept. 22, 1.00-5.00 p.m. (Tues.)	Registration, Juniors
Sept. 23, 8.00 a.m.-12.00 m. (Wed.)	Registration, Seniors
Sept. 23, 3.30 p.m. (Wed.)	First term begins
Oct. 7 (Wed.)	Founder's Day
Nov. 19 (Thurs.)	Mid-term reports
Nov. 25, 4.00 p.m. (Wed.)	Thanksgiving holidays begin
Nov. 30, 8.00 a.m. (Mon.)	Thanksgiving holidays end
Dec. 19, 12.00 m. (Sat.)	Christmas holidays begin

UNIVERSITY CALENDAR

1926

Jan. 5, 8.00 a.m. (Tues.)	Christmas holidays end
Feb. 1, 8.00 a.m. (Mon.)	Examinations begin
Feb. 6, 5.00 p.m. (Sat.)	Examinations end
Feb. 9, 8.00 a.m.-12.00 m. (Tues.)	Registration, Freshmen
Feb. 9, 1.00-5.00 p.m. (Tues.)	Registration, Sophomores
Feb. 10, 8.00 a.m.-12.00 m. (Wed.)	Registration, Juniors
Feb. 10, 1.00-5.00 p.m. (Wed.)	Registration, Seniors
Feb. 11, 8.00 a.m. (Thurs.)	Second term begins
Feb. 22 (Mon., Washington's Birthday)	Junior Oratorical Contest
March 31, 4.00 p.m. (Wed.)	Easter holidays begin
April 5, 8.00 a.m. (Mon.)	Easter holidays end
Apr. 8 (Thurs.)	Mid-term reports
May 31, 8.00 a.m. (Mon.)	Examinations begin
June 5, 5.00 p.m. (Sat.)	Examinations end
June 12 (Sat.)	Alumni Day
June 13 (Sun.)	Baccalaureate Sunday
June 14 (Mon.)	Class Day
June 15 (Tues.)	University Day
June 16, 17, 18, 19 (Wed., Thurs., Fri., Sat.)	Examinations for admission

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* Deceased, November 28, 1924.

† Deceased, February 15, 1925.

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JAMES DAVID WEINLAND, A.M.

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(On part time)

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HERMAN ZINN DRAWBAUGH, M.A.

Instructor in English

FRANK JOHN GEORGE DUCK, B.S., CH.E.

Instructor in Metallurgy

PHILIP GEOFFREY BRITTON GILBERT, PH.D.

Instructor in Geology

NELSON S. HIBSHMAN, B.A.

Instructor in Electrical Engineering

LOUIS ERNEST JAMES, A.B., A.M.

Instructor in Physics

WILLIAM LEVI KICHLIN, B.A.

Instructor in Mathematics

WILBUR HARRY ODA, A.B.

Instructor in Romance Languages

RANDOLPH RECTOR, M.A., B.D.

Instructor in English

THEODORE ALBERTUS SMITS, B.A., E.E.

Instructor in Physics

LOUIS J. WALDBAUER, Ph.D.

Instructor in Chemistry

JAMES ROLAND WARE, A.B.

Instructor in Latin

ASSISTANTS

JUDSON GRAY SMULL, B.S., M.S.

Assistant in Chemistry

EDWARD CHARLES ROEST, M.A.

Assistant in German

MARCUS CABRIN OLD, B.A.

Assistant in Biology

THOMAS JOSEPH LAVIN, SERGEANT OF INF., U. S. A.

Assistant in Military Science and Tactics

PAUL EMIL BOWMAN, Ch.E.

Assistant in Chemistry

FRED JOHN MOHRING, STAFF SERGEANT, U. S. A.

Assistant in Military Science and Tactics

JOHN PATRICK McMANN, SERGEANT OF INF., U. S. A.

Assistant in Military Science and Tactics

WALTER EUGENE THRUN, Ph.D.

Assistant in Chemistry

COMMITTEES OF THE FACULTY

(The term of each member expires in June of the year given in parenthesis after his name,)

Admissions: DEAN McCONN (*ex officio*), PROFESSORS THAYER (1925), FOX (1926), PALMER (1927), THORNBURG (1928), HUGHES (1929), REYNOLDS (1930), ANDERSON (1931).

Advanced Standing: DEAN McCONN (*ex officio*), VICE-PRESIDENT EMERY (1925), PROFESSOR REYNOLDS (1926).

Athletics (faculty members of the Board of Control of Athletics): PROFESSORS REITER (*ex officio*), MESCHTER (1925), CAROTHERS (1926), BEAVER (1927).

Discipline: DEAN McCONN (*ex officio*), PROFESSORS BABASINIAN (1925), LUCH (1926), WILSON (1927).

Educational Policy: PRESIDENT RICHARDS (*ex officio*), PROFESSORS PALMER (1925), LAMBERT* (1926), SEYFERT (1926), MILLER (1927), FOGG (1928), BABASINIAN (1929).

Extension Courses†: DIRECTOR HUGHES (*ex officio*), PROFESSORS CHAPMAN (1925), LUCH (1926), SCHEALER (1927), MACNUTT (1928), THOMAS (1929).

Founder's Day and Commencement: PROFESSORS McCAMMON (1925), LONG (1926), BROWN (1927), BECK (1928), LARKIN (1929).

Graduate Courses: PROFESSORS FOX (1925), HALL (1926), THAYER (1927), E. KLEIN (1928), BROWN (1929).

Honorary Degrees: PRESIDENT RICHARDS (*ex officio*), PROFESSORS ESTY (1925), ECKFELDT (1926), STOUGHTON (1927), ULLMANN (1928), BUTTERFIELD (1929), GOODWIN (1930).

Library: PRESIDENT RICHARDS (*ex officio*), LIBRARIAN LEACH (*ex officio*), PROFESSORS GOODWIN (1925), STOUGHTON (1926), MILLER (1927), CAROTHERS (1928).

Petitions: DEAN McCONN (*ex officio*), PROFESSORS SEYFERT (1925), DIEFENDERFER (1926).

Standing of Students: DEAN McCONN, PROFESSORS PALMER, CAROTHERS, FOGG, LARKIN, STOUGHTON, ECKFELDT, ESTY, BABASINIAN, CHAPMAN, MACNUTT (all members *ex officio*).

Student Activities: DEAN McCONN (*ex officio*), PROFESSORS TOOBY (1925), ECKFELDT (1926), SCHEALER (1927), LARKIN (1928), LEWIS (1929).

SUMMER SESSION: DIRECTOR HUGHES (*ex officio*), PROFESSORS REYNOLDS (1925), E. KLEIN (1926), GIPSON (1927), LUCH (1928), LONG (1929).

* Deceased, February 15, 1925; succeeded on the Committee by Professor Seyfert.

† This Committee was discontinued December 1, 1924.

OFFICERS OF ADMINISTRATION

Office of the President

CHARLES RUSS RICHARDS, M.M.E., ENG.D., LL.D., *President*

Office of the Vice-President and Comptroller

NATT MORRILL EMERY, M.A., LITT.D., *Vice-President and Comptroller*

FREDERICK RALPH ASHBAUGH, *Bursar and Purchasing Agent*

MELVIN SCHISSLER, *Bookkeeper*

ENGLEBERT HENRY BADERSCHNEIDER, *Manager of Supply Bureau*

PAUL ROESTEL, *Steward of the University Commons* *

J. CLARENCE CRANMER, *Superintendent of Buildings and Grounds*

JOHN D. HARTIGAN, *Master Mechanic*

Office of the Dean

CHARLES MAXWELL MCCONN, A.M., *Dean*

EARL KENNETH SMILEY, A.B., *Assistant Dean and Registrar*

ORA INGLE HICKEY, B. S., *Recorder*

Heads of Curricula

PHILIP MASON PALMER, A.B., *Head of the College of Arts and Science*

NEIL CAROTHERS, PH.D., *Head of the College of Business Administration*

RALPH JUSTIN FOGG, B.S., *Head of the Curriculum in Civil Engineering*

FRED VIAL LARKIN, B.S., M.E., *Head of the Curriculum in Mechanical Engineering*

BRADLEY STOUGHTON, PH.B., B.S., *Head of the Curriculum in Metallurgy*

* The Commons was discontinued December 20, 1924.

HOWARD ECKFELDT, B.S., E.M., *Head of the Curriculum in Mining Engineering*

WILLIAM ESTY, S.B., M.A., *Head of the Curriculum in Electrical Engineering*

HARRY MAAS ULLMAN, PH.D., *Head of the Curricula in Chemistry and Chemical Engineering* (On leave of absence 1924-25)

VAHAN SIMON BABASINIAN, A.M., PH.D., *Acting Head of the Curricula in Chemistry and Chemical Engineering*

LAWRENCE BOYLSTON CHAPMAN, S.B., *Head of the Curriculum in Marine Engineering and Transportation*

BARRY MACNUTT, E.E., M.S., *Head of the Curriculum in Engineering Physics*

Legal Counsel

ROBERT SAYRE TAYLOR, B.S., *Legal Counsel*

Linderman Memorial Library

HOWARD SEAVOY LEACH, A.M., *Librarian*

CORA KNUTSFORD DUNNELLS, *Cataloger*

MARJORY DASCOM TAYLOR, S.B., *Circulation Desk Attendant*

Packer Memorial Church

REV. D. WILMOT GATESON, A.B., *Chaplain*

THOMAS EDGAR SHIELDS, A.A.G.O., *Organist*

Students' Health Service

RAYMOND COOLEY BULL, B.S., A.B., M.D., *Director*

DONNA PETERS WILLS, R.N., *Nurse in charge of Dispensary*

University Band

THOMAS EDGAR SHIELDS, A.A.G.O., *Director*

LEHIGH UNIVERSITY

GENERAL STATEMENT

Lehigh University was chartered by the Legislature of Pennsylvania by an act dated February 9, 1866. In 1865 the Hon. Asa Packer, of Mauch Chunk, inaugurated a movement to provide an institution that would afford training and education in the learned professions as then recognized, and in technical branches, the importance of which was then just becoming apparent in the development of the industrial and transportation interests of the country. He made an initial donation of \$500,000 and of a large tract of land for this purpose, to which he added largely during his lifetime and by his will.

Since its foundation the equipment and resources of the University have steadily increased due to the continued interest of the University's trustees, alumni, and friends. The present endowment totals \$3,000,000. The first important addition to the University's original plant was the Sayre Observatory, donated in 1869 by Robert H. Sayre, of Bethlehem. Later donations include Packer Memorial Church, 1887; Williams Hall, 1902; Drown Memorial Hall, 1907; the University Commons, 1907; the Wilbur Heating Plant and Engineering Laboratory, 1907; Taylor Hall, 1907; Sayre Park, 1909; the Coxe Mining Laboratory, 1910; the Fritz Engineering Laboratory, 1910; Taylor Gymnasium and Taylor Field, 1913; the Alumni Memorial Building, 1924.

Lehigh University offers the following curricula:

COLLEGE OF ARTS AND SCIENCE:

- The Curriculum in Arts and Science
- The Pre-Medical Curriculum
- Courses in Preparation for Teaching.

COLLEGE OF BUSINESS ADMINISTRATION:

- The Curriculum in Business Administration

COLLEGE OF ENGINEERING:

- The Curriculum in Civil Engineering
- The Curriculum in Mechanical Engineering

The Curriculum in Metallurgical Engineering
 The Curriculum in Mining Engineering
 The Curriculum in Electrical Engineering
 The Curriculum in Chemistry
 The Curriculum in Chemical Engineering
 *The Curriculum in Marine Engineering and Transportation
 The Curriculum in Engineering Physics
 The Curriculum in Industrial Engineering

These curricula are described in detail on pages 30 to 88.

REQUIREMENTS FOR ADMISSION

Candidates for admission to Lehigh University must be at least sixteen years of age, must present testimonials of good moral character, and must be qualified in fifteen entrance units* as enumerated below. The regular undergraduate curricula are open to men only.

All students entering the University are required to present a certificate of vaccination against small-pox within three years of the time of entering the University. They must also have a scar as evidence of previous successful vaccination. Students who cannot comply with the above will be vaccinated by the Director of the Health Service, and in case the vaccination is unsuccessful will be re-vaccinated. No charge is made for this service.

THE COLLEGE OF ARTS AND SCIENCE

Candidates for admission to the College of Arts and Science must present the following subjects:

	Units†
English,	3
History,	1
Elementary Algebra,	1½
Plane Geometry,	1
Latin A and B, or German A, or French A, or Spanish A,	2
Elective subjects,	6½
	15

* The Curriculum in Marine Engineering and Transportation has been discontinued, effective in June, 1925.

† A unit represents a year's study in any subject in a secondary school, constituting approximately a quarter of a full year's work. A four-year secondary school curriculum should be regarded as representing not more than sixteen units of work.

THE COLLEGE OF BUSINESS ADMINISTRATION

Candidates for admission to the College of Business Administration must present the following subjects:

	Units*
English,	3
History,	1
Elementary Algebra,	1½
Plane Geometry,	1
Latin A and B, or German A, or French A, or	
Spanish A,	2
Elective subjects,	6½
	15

THE COLLEGE OF ENGINEERING

Candidates for admission to the College of Engineering must present the following subjects:

	Units*
English,	3
History,	1
Elementary Algebra,	1½
Plane Geometry,	1
Solid Geometry,	½
Plane Trigonometry and Logarithms,	½
German A, or French A, or Spanish A, or	
Latin A and B,	2
Elective subjects,	5½
	15

ELECTIVE SUBJECTS

	Units*
Advanced Algebra,	½
Solid Geometry,	½
Plane Trigonometry and Logarithms,	½
Greek,	1, 2, or 3
Latin,	1, 2, 3, or 4
French,	1, 2, or 3
German,	1, 2, or 3
Spanish,	1, 2, or 3
American History,	1
Ancient History,	½ or 1
Modern History,	1
English History,	½ or 1
Civics,	½, 1, or 1½
Economics,	½ or 1
General Science,	1
Physics,	1
Chemistry,	1
Biology,	½ or 1
Physiology and Hygiene,	½ or 1
Physiography,	½ or 1
Manual Training,	½ or 1
Freehand Drawing,	½
Mechanical Drawing,	½
Industrial History,	½ or 1
Commercial Geography,	½ or 1
Bookkeeping, Stenography, and	
Typewriting,	1 or 2

* A unit represents a year's study in any subject in a secondary school, constituting approximately a quarter of a full year's work. A four-year secondary school curriculum should be regarded as representing not more than sixteen units of work.

Other subjects from the curriculum of a high school of the first class may be credited up to a total of one unit.

Detailed information concerning these subjects is given on pages 24 to 29.

ADMISSION BY CERTIFICATE

Lehigh University has no permanent arrangement with any school whereby certificates are accepted in place of entrance examinations; but certificates are ordinarily accepted from First-Class High Schools in Pennsylvania, and from schools accredited by the Association of Colleges and Secondary Schools of the Middle States and Maryland, the New England College Entrance Certificate Board, the Regents of the University of the State of New York, the North Central Association of Colleges and Secondary Schools, the Association of Colleges and Secondary Schools of the Southern States, and the state universities of those states which have such institutions.

An applicant for admission by certificate should request his school principal to send to the Dean, as soon as the school closes in June, a complete record of his work. Blanks for this purpose will be supplied by the University.

Each candidate for admission must present full school and college records from each institution previously attended. Failure to present such records will result in cancellation of registration.

ADMISSION BY EXAMINATION

Examinations at the University

Examinations for admission to the University are held in June and September in the following order:

First Day.—Geometry, 8 a.m.; Physics, Ancient History, 2 p.m.

Second Day.—Elementary Algebra, 8 a.m. to 10 a.m., Intermediate Algebra, 10 a.m. to 12 m.; Trigonometry, 2 p.m.

Third Day.—Latin, 8 a.m.; German, French, Spanish, Greek, 2 p.m.

Fourth Day.—English, 8.30 a.m.; History, 2 p.m.

The dates for 1925 and 1926 are as follows: in 1925, June 10, 11, 12, and 13, and September 16, 17, 18, and 19; in 1926, June 16, 17, 18, and 19, and September 15, 16, 17, and 18.

Examinations in subjects presented for elective units may be arranged for by correspondence with the Dean.

Candidates for admission wishing to take examinations for advanced credit in any subject should notify the Dean before September 1.

Examinations at Schools

Upon the request of school principals the June entrance examinations may be held at schools on the regularly scheduled dates. Requests for examination papers should be sent to the Dean before June 1.

College Board and Regents' Examinations

Certificates of the College Entrance Examination Board and of the Regents of the University of the State of New York are accepted in subjects in which the recorded grade is 60 per cent. or higher.

The examinations of the College Entrance Examination Board are held in June of each year. Information in regard to these examinations, application blanks, and a circular giving detailed definitions of requirements in all examination subjects may be obtained by addressing the Secretary of the College Entrance Examination Board, 431 West 117th Street, New York, N. Y. The price of the circular is twenty cents; it may be remitted in stamps.

ADMISSION TO ADVANCED STANDING

A student desiring to transfer to Lehigh from another college or university should submit an official transcript of his record in the other institution, which should include, with his college credits, a memorandum of the entrance credits accepted for admission to that other institution and a notation of honorable dismissal.

A candidate who has attended more than one other college or university must present a record from each of these institutions; failure to submit a complete record of former

academic experience will result in cancellation of registration.

Graduates of other colleges may be admitted without examinations to the engineering courses of Lehigh University. The length of time for the completion of a course will depend upon the student's attainments at entrance and upon his ability. Every opportunity is given for the completion of a course in minimum time.

A student who anticipates taking a technical course at Lehigh University after graduation from college should so arrange his work in college as to cover as many as possible of the subjects of the freshman and sophomore years of the technical course he intends to enter.

ADMISSION OF SPECIAL STUDENTS

Applicants for special courses may be accepted as special students on the recommendation of the head of the curriculum in which the student proposes to do his special work, approved by the Dean. Candidates must be at least 21 years of age and must present evidence of ability to pursue with profit the subjects which they wish to study at the University.

No student pursuing a special course is permitted to take any subject unless in the opinion of the professor in charge he is thoroughly prepared in all the necessary preceding branches.

ADMISSION TO GRADUATE COURSES

For admission to graduate courses see page 145

ENTRANCE REQUIREMENTS IN DETAIL BY SUBJECTS

ENGLISH

Preparation in English has three main objects: (a) command of correct and clear English, spoken and written; (b) ability to use the vernacular with accuracy and appreciation; and (c) some acquaintance with the simpler English classics.

ENGLISH GRAMMAR AND COMPOSITION. The first two objects require instruction in grammar and composition. English grammar should be reviewed in the secondary school, and correct spelling and grammatical accuracy should be rigorously exacted in connection with all written work during the four years. The principles of English composition governing punctuation, the use of words, paragraphs, and the different

kinds of composition, including letter-writing, should be thoroughly mastered; and practice in composition, oral as well as written, should extend throughout the secondary school period. Written exercises may well comprise narration, description, and easy exposition based upon the principles of elementary rhetoric, as given in any approved high school rhetoric. It is advisable that subjects for this work be taken from the students' personal experience, general knowledge, and studies other than English, as well as from his reading in literature. Finally, special instruction in language and composition should be supported by concerted efforts of teachers in all branches to cultivate in the student the habit of using good English in his recitations and various exercises, whether oral or written, making every recitation in some degree an exercise in English.

LITERATURE. The third object is sought by means of two lists of books, headed respectively reading and study, from which may be framed a progressive course in literature covering four years. In connection with both lists, the student should be trained in reading aloud and be encouraged to commit to memory some of the more notable passages both in verse and in prose. The books for reading and study are to be selected from the groups suggested by the Conference on Uniform Entrance Requirements in English. 3 units

HISTORY

The requirement in history is based on the recommendations of the Committee of Seven of the American Historical Association.

ANCIENT HISTORY, with special reference to Greek and Roman History, including also a short introductory study of the more ancient nations, and the chief events of the early Middle Ages down to the death of Charlemagne (814). 1 unit

MEDIAEVAL AND MODERN EUROPEAN HISTORY, from the death of Charlemagne to the present time. 1 unit

ENGLISH HISTORY, with due reference to social and political development. 1 unit

AMERICAN HISTORY AND CIVIL GOVERNMENT, with due reference to social and political development. 1 unit

The examinations in history will be so framed as to require comparison and the use of judgment on the pupil's part rather than the mere use of memory. The examinations will presuppose the use of good textbooks, collateral reading, and practice in written work. Geographical knowledge will be tested by requiring the location of places and movements on an outline map.

MATHEMATICS

ELEMENTARY ALGEBRA (ALGEBRA TO QUADRATICS). The four fundamental operations for rational algebraic expressions. Factoring, determination of highest common factor and lowest common multiple by factoring. Fractions, including complex fractions, and ratio and proportion. Linear equations, both numerical and literal, containing one or more unknown quantities. Problems depending on linear equations. Radicals, including the extraction of the square root of polynomials and of numbers. Exponents, including the fractional and negative. 1 unit

INTERMEDIATE ALGEBRA (QUADRATICS AND BEYOND). Quadratic equations, both numerical and literal. Simple cases of equations with one or more unknown quantities that can be solved by the methods of linear or quadratic equations. Problems depending on quadratic equations. The binomial theorem for positive integral exponents. The formulas for the n th term and the sum of the terms of arithmetic and geometric progressions with applications. $\frac{1}{2}$ unit

ADVANCED ALGEBRA. Permutations and combinations, limited to simple cases. Complex numbers, with graphical representation of sums and differences. Determinants, chiefly of the second, third, and fourth orders, including the use of minors and the solution of linear equations. Numerical equations of higher degree, and so much of the theory of equations, with graphical methods, as is necessary for their treatment, including Descartes' rule of sign and Horner's method, but not Sturm's functions or multiple roots. $\frac{1}{2}$ unit

PLANE GEOMETRY. The usual theorems and constructions of good textbooks, including the general properties of plane rectilinear figures; the circle and the measurement of angles; similar polygons; areas; regular polygons; and the measurements of the circle. The solution of numerous original exercises, including loci problems. Applications to the mensuration of line and plane surfaces. 1 unit

SOLID GEOMETRY. The usual theorems and constructions of good textbooks, including the relations of planes and lines in space; the properties and measurements of prisms, pyramids, cylinders, and cones; the sphere and the spherical triangle. The solution of numerous original exercises, including loci problems. Applications to the mensuration of surfaces and solids. $\frac{1}{2}$ unit

PLANE TRIGONOMETRY. Definitions and relations of the six trigonometric functions as ratios; circular measurements of angles. Proofs of principal formulas, in particular for the sine, cosine, and tangent of the sum and the difference of two angles, of the double angle and the half angle, the product expressions for the sum or the difference of two sines or of two cosines, etc.; the transformation of trigonometric expressions by means of these formulas. Solution of trigonometric equations of a simple character. Theory and use of logarithms (without the introduction of work involving infinite series). The solution of right and oblique triangles and practical applications. Candidates must bring their logarithmic tables to the examination. $\frac{1}{2}$ unit

Candidates must have a knowledge of the metric system and be prepared to solve problems in either algebra or geometry involving the use of the metric system.

GREEK

GREEK. Grammar; elementary prose composition, consisting principally of detached sentences to test the candidate's knowledge of grammatical construction; Xenophon: the first four books of the *Anabasis*; the translation, at sight, of a passage from some work of Xenophon. 2 units

GREEK. Homer's *Iliad*, I-III: The first three books of the *Iliad* (omitting II, 494-end), and the Homeric forms, constructions, and prosody. 1 unit

LATIN

The following requirements in Latin are in accordance with the recommendations made by the American Philological Association, October, 1909.

LATIN, A and B. First and Second Year Latin. Grammar, elementary prose composition. Reading of an amount not less than Cæsar, *Gallie War*, I-V, selected by the schools from Cæsar (*Gallie War* and *Civil War*) and Nepos (*Lives*). 2 units

LATIN, C. Third Year Latin. Reading of an amount not less than Cicero, *Orations against Catiline*, *For the Manilian Law*, and *For Archias*, selected by the schools from Cicero (*Orations*, *Letters*, and *De Senectute*) and Sallust (*Catiline* and *Jugurthine War*). 1 unit

LATIN, D. Fourth Year Latin. Reading of an amount not less than Vergil, *Aeneid*, I-VI, selected by the schools from Vergil (*Aeneid*, *Bucolics*, and *Georgics*) and Ovid (*Metamorphoses*, *Fasti*, *Tristia*, *Amores*).
1 unit

GERMAN

ELEMENTARY GERMAN, A. This requirement follows, in the main, the recommendation of the Committee of Twelve of the Modern Language Association. It is expected that two whole years will be given to the work.

During the first year the work should comprise: (1) Careful drill in pronunciation. (2) The memorizing and frequent repetition of easy colloquial sentences. (3) Drill upon the rudiments of grammar, that is, upon the inflection of the articles, of such nouns as belong to the language of everyday life, of adjectives, pronouns, weak verbs, and the more usual strong verbs; also upon the use of the more common prepositions, the simpler use of the modal auxiliaries, and the elementary rules of syntax and word-order. (4) Abundant easy exercises, designed not only to fix in mind the forms and principles of grammar, but also to cultivate readiness in the reproduction of natural forms of expression. (5) Reading of from 75 to 100 pages of graduated texts from a reader, with constant practice in translating into German easy variations upon sentences selected from the reading lesson (the teacher giving the English), and in the reproduction from memory of sentences previously read.

During the second year the work should comprise: (1) The reading of from 150 to 200 pages of literature in the form of easy stories and plays. (2) Accompanying practice, as before, in the translation into German of easy variations upon the matter read and in the off-hand reproduction, sometimes orally and sometimes in writing, of the substance of short and easy selected passages. (3) Continued drill in the rudiments of the grammar, directed to the ends of enabling the pupil, first, to use his knowledge with facility in the formation of sentences, and, secondly, to state his knowledge correctly in the technical language of grammar.
2 units

INTERMEDIATE GERMAN, B. This work should comprise, in addition to the elementary course, the reading of about 400 pages of moderately difficult prose and poetry, with constant practice in giving, sometimes orally and sometimes in writing, paraphrases, abstracts, or reproductions from memory of selected portions of the matter read; also grammatical drill upon the less usual strong verbs, the use of articles, cases, auxiliaries of all kinds, tenses, and modes (with special reference to the infinitive and the subjunctive), and likewise upon word order and word formation.
1 unit

FRENCH

ELEMENTARY FRENCH, A. This requirement follows in the main the recommendation of the Committee of Twelve of the Modern Language Association. It is expected that two whole years will be given to the work.

During the first year the work should comprise: (1) Careful drill in pronunciation. (2) The rudiments of grammar, including the inflection of the regular and the more common irregular verbs, the plural of nouns, the inflections of adjectives, participles, and pronouns; the use of personal pronouns, common adverbs, prepositions, and conjunctions; the order of words in the sentence and the elementary rules of syntax. (3) Abundant easy exercises, designed not only to fix in the memory the forms and principles of grammar, but also to cultivate readiness in the reproduction of natural forms of expression. (4) The reading of from 100 to 175 pages of graduated texts, with constant practice in translating into French easy variations of the sentences read (the teacher giving the English), and in reproducing from memory sentences previously read. (5) Writing French from dictation.

During the second year the work should comprise: (1) The reading of from 250 to 400 pages of easy modern prose in the form of stories, plays, or historical or biographical sketches. (2) Constant practice, as in the previous year, in translating into French easy variations upon the texts read. (3) Frequent abstracts, sometimes oral and sometimes written, of portions of the text already read. (4) Writing French from dictation. (5) Continued drill upon the rudiments of grammar, with constant application in the construction of sentences. (6) Mastery of the forms and uses of pronouns and pronominal adjectives, of all but the rare irregular verb forms, and of the simpler uses of the conditional and subjunctive.

2 units

INTERMEDIATE FRENCH, B. This should comprise the reading of from 400 to 600 pages of French of ordinary difficulty, a portion to be in the dramatic form; constant practice in giving French paraphrases, abstracts, or reproductions from memory of selected portions of the matter read; the study of a grammar of moderate completeness; writing from dictation.

1 unit

SPANISH

ELEMENTARY SPANISH, A. Two years' preparation, covering the following ground:

During the first year: (1) Drill in the correct production of Spanish sounds. (2) The rudiments of grammar, illustrated by abundant easy exercises. (3) The reading of about 150 pages of graduated text with constant translating into Spanish of easy variations of sentences read, the teacher giving the English. (4) Aural drill: practice in translating into English Spanish words, clauses, and sentences heard but not seen, the teacher giving the Spanish.

During the second year: (1) Reading of 250 to 400 pages of easy modern prose. (2) Constant practice in translating into Spanish easy variations upon the text read. (3) Aural practice and drill in pronunciation. (4) Mastery of the forms and uses of pronouns, of the subjunctive mode, and of the forms of the radical changing verbs.

2 units

INTERMEDIATE SPANISH, B. The reading of not less than 500 additional pages of Spanish prose together with the translation of at least 40 pages of simple connected English prose into Spanish.

1 unit

PHYSICS

The course of instruction in physics should include:

(a) The study of some standard text-book, for the purpose of obtaining a connected view of the subject; (b) instruction by lecture table demonstrations, to be used mainly for illustration of the facts and phenomena of physics; (c) individual laboratory work consisting of at least thirty experiments.

The aim of laboratory work should be to supplement the pupil's fund of concrete knowledge and to cultivate his power of accurate observation and clearness of thought and expression. The exercises should be chosen with a view to furnishing forceful illustrations of fundamental principles and their practical applications. They should be such as to yield results capable of ready interpretation, obviously in conformity with theory, and free from the disguise of unintelligible units.

1 unit

CHEMISTRY

The requirement in chemistry is based on the report of the Committee on Chemistry of the Science Department of the National Education Association.

ELEMENTARY CHEMISTRY. It is recommended that the candidate's preparation in chemistry include: (a) individual laboratory work, comprising at least forty exercises; (b) instruction by lecture table demonstrations, to be used mainly as a basis for questioning upon the general principles involved in the pupil's laboratory investigations; (c) the study of at least one standard text-book, to the end that the pupil may gain a comprehensive and connected view of the most important facts and laws of elementary chemistry. 1 unit

Students properly qualified will be examined in Elementary Chemistry on the first Saturday of the term; those passing the examination will be privileged to omit Elementary Chemistry (390) and will take instead Chemistry (393) and Chemical Laboratory (393a) during the first term.

ZOOLOGY

ZOOLOGY. The equivalent of Jordan, Kellogg, and Heath's *Animal Studies*, with laboratory work. ½ or 1 unit

BOTANY

BOTANY. An amount equal to that contained in Bergen's *Foundations of Botany*, with laboratory work. ½ or 1 unit

PHYSIOLOGY AND HYGIENE

PHYSIOLOGY AND HYGIENE. A course covering approximately what is given in such a text-book as Huxley and Youman's *Physiology and Hygiene*. ½ or 1 unit

PHYSIOGRAPHY

PHYSIOGRAPHY. The study of a standard text-book in physical geography, that a knowledge may be gained of the essential principles and of well-selected facts illustrating those principles. Individual laboratory work, comprising at least forty exercises, with notebook, is recommended. ½ or 1 unit

DRAWING

FREEHAND DRAWING. Sketching of simple geometrical figures, of objects, and from copy. At least twenty plates must be submitted. ½ unit

MECHANICAL DRAWING. The use of instruments and the preparation of at least twenty plates, illustrating the elements of descriptive geometry or simple machine parts. ½ unit

MANUAL TRAINING

MANUAL TRAINING. Shop work in wood or metal in schools giving courses in manual training. ½ or 1 unit

BOOKKEEPING, TYPEWRITING, AND STENOGRAPHY

BOOKKEEPING, TYPEWRITING, AND STENOGRAPHY, covering a formal course of study in school. 1 or 2 units

THE COLLEGE OF ARTS AND SCIENCE

The College of Arts and Science of Lehigh University represents the traditional college curriculum, modified to meet the needs of modern life and thought. Such a curriculum is, in its purpose, primarily informing and cultural, not vocational; it seeks to gratify intellectual curiosity, to cultivate a love of learning, to impart the knowledge and discipline which are essential to intelligent and forceful living. It has besides certain specific uses: it is the customary approach to the professions of medicine, law, theology, and teaching, and the usual basis for graduate study for higher degrees.

The entrance requirements are liberal, and such as may be met readily by graduates of Pennsylvania high schools of the first class. A statement of them may be found on page 20.

The plan of study comprises required subjects and unasigned or elective subjects. The required and elective subjects occupy respectively about two-thirds and one-third of the curriculum. The required studies embrace courses in the English, German, and French languages and literatures (two years each), mathematics (trigonometry and solid geometry), economics, history, psychology, biology, geology, and philosophy, subjects which may be regarded as fundamental to the nature and purpose of the course.

The studies of the freshman year follow in general the subjects which have been presented for entrance. After the freshman year the curriculum becomes increasingly elective, a minimum of three hours weekly of electives being allowed in the sophomore year, six in the junior year, and twelve in the senior year. The Head of the Curriculum counsels students in the choice of their studies and keeps before them the importance of selecting their work according to a definite and constructive plan. Students are dealt with individually rather than in groups, and the effort is made to suit the studies of each to his qualifications and purposes. During the first term of the junior year each student must select some sequence of studies as his major field. A major consists of at least twelve term hours of advanced work in the field chosen. Majors must be approved by the Head of the Curriculum and the professors concerned.

The minimum course of study comprises fifteen scholastic hours or periods weekly. Work is assigned on the assumption that two hours are required by the average student to prepare adequately for a recitation. Students of proved ability, however, are not limited to this minimum. In general, the College aims at a reasonable amount of work well done, rather than a large amount indifferently done.

Instruction is given by lectures, by recitations, by the assignment of readings and topics for study and dissertations, and, when the subject admits of it, by practical work in field or laboratory. Field work or laboratory work accompanies courses in geology, physics, chemistry, biology, psychology, and allied subjects. Practice in teaching is provided in the schools of the vicinity for those who expect to follow teaching. Students residing in Leonard Hall, who are preparing under the direction of the Bishop of the Episcopal Diocese of Bethlehem for the theological seminary, have opportunity for practical religious work.

In the following plan of study the unassigned hours are filled by subjects selected from the listed elective studies. These are not necessarily confined to the year to which they are assigned in the lists, but may be taken earlier or subsequently. But this privilege is limited by considerations of the roster and the principle that the course of each student shall be systematic and not haphazard.

Students who enter with full entrance requirements in Latin and Greek (four or three units) will continue these studies during the freshman year. A class in Beginners' Greek, open to freshmen and sophomores, is formed in alternate years. Students who begin Greek in college will ordinarily pursue the study of Greek for three years.

The degree of Bachelor of Arts (B.A.) is conferred upon graduates of the College of Arts and Science.

THE CURRICULUM IN ARTS AND SCIENCE

Total Hours Required for the Degree of Bachelor of Arts: 136

FIRST TERM			FRESHMAN YEAR			SECOND TERM		
<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>	<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>	<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>
English	120	(3)	English	125a	(3)	English	124	(3)
Plane Trig.	141	(3)	Solid Geom.	140	(3)	Economics	17	(3)
German	77 or 70	}	German	77 or 71	}	German ... 71, 77, or 79	(3)	(3)
or French	98		or French	99		French	90 or 100	(3)
Latin	45 or 45a	}	Latin	46 or 54b	}	Electives	—	(3)
or A. Civ.	47		or A. Civ.	47		Mil. Sci.	471	(1½)
Greek	55 or 64	}	Greek	56 or 64	}	Phys. Ed.	501-9	(1½)
or Chem.	390 (2)		or Chem.	395 (2)		Chapel	—	(½)
and Chem. Lab. 392 (1)	(1)	}	and Stoich.	397 (1)	}	College and Orienta-	—	(½)
or Physics	331		or Physics	331		tion Lectures....	—	(½)
Mil. Sci.	470	(1½)	Mil. Sci.	470	(1½)			
*Hygiene Lectures..	500a	(¼)	Phys. Ed.	501-9	(½)			
*Phys. Ed.	501-9	(½)	Chapel	—	(½)			
Chapel	—	(½)	College and Orienta-	—	(½)			
College and Orienta-	—	(½)	tion Lectures....	—	(½)			
tion Lectures....	—	(½)						
		18						18

FIRST TERM			SOPHOMORE YEAR			SECOND TERM		
<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>	<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>	<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>
English	123	(3)	English	124	(3)	English	124	(3)
Economics	16	(3)	Economics	17	(3)	Economics	17	(3)
German 70, 77, or 78	(3)	(3)	German	71, 77, or 79	(3)	German ... 71, 77, or 79	(3)	(3)
French	90 or 100	(3)	French	90 or 101	(3)	French	90 or 101	(3)
Electives	—	(3)	Electives	—	(3)	Electives	—	(3)
Mil. Sci.	471	(1½)	Mil. Sci.	471	(1½)	Mil. Sci.	471	(1½)
Phys. Ed.	501-9	(½)	Phys. Ed.	501-9	(½)	Phys. Ed.	501-9	(½)
Chapel	—	(½)	Chapel	—	(½)	Chapel	—	(½)
College Lectures	—	(¼)	College Lectures	—	(¼)	College Lectures	—	(¼)
		17¾			17¾			17¾

FIRST TERM			JUNIOR YEAR			SECOND TERM		
<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>	<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>	<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>
Psychology	1	(3)	Psychology	2	(3)	Psychology	2	(3)
French	97	}	French	97	}	French	97	}
or German	77		or German	77		or German	77	
Biology	292	(3)	Gen. Geology	268	(2)	Gen. Geology	268	(2)
Electives	—	(6)	Geol. Lab.	269	(1)	Geol. Lab.	269	(1)
Phys. Ed.	501-9	(1)	Electives	—	(6)	Electives	—	(6)
College Lectures	—	(¼)	Phys. Ed.	501-9	(1)	Phys. Ed.	501-9	(1)
		16¼	College Lectures	—	(¼)	College Lectures	—	(¼)
		16¼			16¼			16¼

FIRST TERM			SENIOR YEAR			SECOND TERM		
<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>	<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>	<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>
Philosophy	8	(3)	Philosophy	9	(3)	Philosophy	9	(3)
Electives	—	(12)	Electives	—	(12)	Electives	—	(12)
Phys. Ed.	501-9	(1)	Phys. Ed.	501-9	(1)	Phys. Ed.	501-9	(1)
		16			16			16

* Hygiene Lectures, 500a, first three weeks; Physical Education, 501-9, the remainder of the term.

ELECTIVE STUDIES

In order that elective studies may be incorporated, so far as possible, in the University roster from term to term without conflicts, students are required to submit their electives to the professor in charge of electives, for the first term on or before May 1, for the second term on or before December 15.

(Figures in parentheses indicate number of credit hours a week. Other figures indicate course numbers.)

FIRST TERM		SOPHOMORE ELECTIVES		SECOND TERM	
Advanced Algebra (4)	143	Botany (3)	290		
European History (3)	524	Plane Analytic Geom. (3)	145		
Physics (3)	331	European History (3)	525		
Physics (2)	332	Physics (3)	331		
Elementary Mechanics (3)	320	Physics (3)	332		
Latin (3)	48	Mechanics & Heat (3)	321		
Greek (3)	57, 64 or 65	Physical Measurements (1)	322		
Advanced Chemistry (3)	398	Latin (3)	49		
Physiography (2)	277	Greek (3)	58, 64 or 65		
Education (3)	11	Advanced Chemistry (3)	399		
Chem. (3)	390 and 392	Scientific Method (3)	10		
Am. Gov. (3)	542	Spherical Trigonometry (1)	142		
Econ. Geog. (3)	35	Stoichiometry (1)	397		
		Education (3)	12		
		Am. Gov. (3)	543		
		Chem. (3)	395 and 397		
		Econ. Geog. (3)	36		

FIRST TERM		JUNIOR ELECTIVES		SECOND TERM	
U. S. History (3)	534	U. S. History (3)	535		
Latin (3)	50 or 52	Latin (3)	51 or 53		
Greek (3)	55, 59 or 61	Greek (3)	56, 60 or 62		
French (3)	98, 100 or 102	French (3)	99, 101 or 102		
or German (3)	78, 77 or 80	or German (3)	79, 77 or 80		
Spanish (3)	110	Spanish (3)	110		
Dif. Cal. & S. A. Geom. (4)	146	Integral Calculus (4)	147		
Higher Algebra (1)	144	Physics (3)	333		
Physics (3)	333	Quantitative Analysis(5)	404, 405		
Quantitative Analysis(5)	400, 402	Ren. Hist. (3)	523		
Ren. Hist. (3)	522	Comparative Anatomy (3)	293		
English (3)	126, 129, 130 or 132	English (3)	128, 131, 133 or 134		
Mineralogy (4)	266	Education (3)	14		
Education (3)	13	Education (1-3)	16		
Education (1-3)	16	Italian (3)	117		
Italian (3)	117	Economic Geography (3)	36		
Economic Geography (3)	35	Business Law (2)	32		
Business Law (2)	31	Labor Legislation (3)	23		
Labor Legislation (3)	23	Geological Lab. (2)	269		

FIRST TERM		SENIOR ELECTIVES		SECOND TERM	
Latin (3)	50 or 52	Latin (3)	51 or 53		
Greek (3)	57, 59 or 61	Greek (3)	58, 60, or 62		
German (3)	81 or 82	German (3)	81 or 82		
French (3)	100, 102, 103 or 104	French (3)	101, 102, 103 or 104		
Italian (2)	118	Italian (3)	118		
Spanish (3)	114	Spanish (3)	114		
English (3)	126, 129 or 130	English (3)	128, 131 or 134		
Organic Chemistry (5)	408, 409	Organic Chemistry (4)	410		
Banking (3)	27	Organic Chem. Lab. (3)	411		
Education (1-3)	16	Banking (3)	27		
Psychology (3)	3	Education (3)	15		
Embryology (3)	294	Education (1-3)	16		
Bacteriology (2)	296	Botany (3)	290		

Experimental Psychology(1)	7	Physiology (2)	298
Finance (3)	19	Advanced Bacteriology (2)	297
Physics (3)	334 or 335	Psychology (3)	4
Physics Lab. (2)	337	Experimental Psychology (1)	7
Analytic Mechanics (2)	149	Finance (3)	19
Field Geology (3)	275	Physics (3)	334 or 336
Petrography (2)	276	Physics Lab. (2)	337
Differential Equations (1)	148	Astronomy (3)	150
Adv. Elec. & Mag. (2)	327	Paleontology (3)	272
Electrical Laboratory (1)	328	Geology of N. A. (3)	273
Colonial History (3)	532	Electrical Laboratory (1)	329
Sociology (3)	24a	Analytic Mechanics (3)	152
Comparative Government(3)	545	Colonial History (3)	533
		Sociology (3)	24a
		Comparative Government(3)	545

PREPARATION FOR ENGINEERING COURSES

If a student in the College of Arts and Science contemplates becoming a candidate for a degree in engineering after the completion of his B.A. course, he should choose as electives during the third and fourth years of his B.A. course such science studies as are contained in the first and second years of the technical curriculum which he wishes afterwards to complete. By carefully selecting electives, with the advice and guidance of the head of his department and the professor in charge of the technical curriculum concerned, the graduate of the B.A. course may enter the technical course chosen as a junior in full standing, and obtain his technical degree in two years of further study.

PRE-MEDICAL CURRICULA

Certain medical schools require for entrance a college course in addition to a high school course; others require a high school course yielding fourteen or more college entrance credits and at least two years in a college of liberal arts with about three-fourths of the study devoted to chemistry, physics, and biology.

The following four-year curriculum has been prepared for students who intend to enter a medical school, but plan, before doing so, to complete their college course and obtain their degree.

THE PRE-MEDICAL CURRICULUM

*Total Hours Required for the Degree of Bachelor of Arts
(Pre-Medical): 144*

FIRST TERM			FRESHMAN YEAR			SECOND TERM		
<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>		<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>		
English	120	(3)		English	125a	(3)		
Plane Trig.	141	(3)		Solid Geom.	140	(3)		
German	77 or 70	}	(3)	German	77 or 71	}	(3)	
or French	98			or French	99			
Latin	45 or 54a	}	(3)	Latin	46 or 54b	}	(3)	
or A. Civ.	47			or A. Civ.	47			
Chemistry ...	390 or 393	(2)		Qual. Anal.	395	(3)		
Chem. Lab. ...	391 or 393a	(2)		Stoichiometry ...	397	(1)		
Mil. Sci.	470	(1½)		Mil. Sci.	470	(1½)		
*Hygiene Lectures..	500a	(¼)		Phys. Ed.	501-9	(½)		
*Phys. Ed.	501-9	(¼)		Chapel	—	(½)		
Chapel	—	(½)		College and Orienta-	—	(½)		
College and Orienta-	—	(½)		tion Lectures....	—	(½)		
tion Lectures....	—	(½)						
			19					19

FIRST TERM			SOPHOMORE YEAR			SECOND TERM		
English	123	(3)		English	124	(3)		
French	90 or 100	(3)		French	90 or 101	(3)		
German ...	70, 77 or 78	(3)		German ...	71, 77, or 79	(3)		
Physics	331	(3)		Physics	331	(3)		
Adv. Chem.	398	(3)		Adv. Chem.	399	(3)		
Mil. Sci.	471	(1½)		Mil. Sci.	471	(1½)		
Phys. Ed.	501-9	(½)		Phys. Ed.	501-9	(½)		
Chapel	—	(½)		Chapel	—	(½)		
College Lectures ...	—	(¼)		College Lectures ...	—	(¼)		
			17¾					17¾

FIRST TERM			JUNIOR YEAR			SECOND TERM		
Psychology	1	(3)		Psychology	1	(3)		
French	97	}	(3)	French	97	}	(3)	
or German	77			or German	77			
Biology	292	(3)		Comp. Anat.	293	(3)		
Quant. Anal.	400	(3)		Biology	292	(3)		
Quant. An. Conf....	402	(1)		Economics	17	(3)		
Economics	16	(3)		Physics	332	(2)		
Physics	332	(2)		Phys. Ed.	501-9	(1)		
Phys. Ed.	501-9	(1)		College Lectures ...	—	(¼)		
College Lectures ...	—	(¼)						
			19¼					18¾

FIRST TERM			SENIOR YEAR			SECOND TERM		
Philosophy	8	(3)		Philosophy	9	(3)		
Org. Chem.	408	(3)		Org. Chem.	410	(4)		
Org. Chem. Lab....	409	(2)		Org. Chem. Lab....	411	(2)		
Embryology	294	(3)		Psychology	4	(3)		
Bacteriology	296	(2)		Electives	—	(3)		
Electives	—	(3)		Phys. Ed.	501-9	(1)		
Phys. Ed.	501-9	(1)						
			17					16

* Hygiene Lectures, 500a, first three weeks; Physical Education, 501-9, the remainder of the term.

For students who cannot devote four years to college work preparatory to entering upon the study of medicine, there may be arranged upon consultation a course which will give the student in two or three years the credits demanded by the medical schools for admission.

PREPARATION FOR TEACHING

In the curriculum leading to the degree of Bachelor of Arts, outlined on pages 30 to 34, the student may, through a selection of suitable electives, equip himself to teach in the high school the subject or subjects he has selected as his specialty, whether in the field of English, of ancient or modern languages, of history and social science, of biology and chemistry, of physics and mathematics, or of physiography and related subjects. In the curriculum in Business Administration he is permitted to substitute, during the junior and senior years, courses in distinctly pedagogical subjects sufficient to make a total of eighteen term hours. He may thus equip himself to teach in secondary schools the important branches of commerce and industry.

No one may teach in the public schools of any state without first securing a license from that state. In Pennsylvania, as in most states, the special examination for such a license is waived in the case of college graduates, provided they have completed a certain number of hours in distinctly pedagogical studies and have applied for a provisional college certificate to teach. At the end of three years of successful experience in teaching the State of Pennsylvania issues a permanent college certificate.

The requirement in this State for a provisional college graduate certificate to teach is as follows:

Professional Training,	Eighteen semester hours
Introduction to Teaching,	Three semester hours
Educational Psychology,	Three semester hours
Practice Teaching,	Six semester hours
Elective professional studies,	Six semester hours
Study of subject matter,	Twelve semester hours in each subject in which the candidate desires certification

The course in education at Lehigh University amply meets these requirements. It may be outlined thus:

FIRST TERM	SOPHOMORE YEAR	SECOND TERM
Introduction to Teaching	(3)	History of Education (3)

FIRST TERM	JUNIOR YEAR	SECOND TERM
General Psychology	(3)	Educational Psychology (3)
Principles of Secondary Education	(3)	School Efficiency (3)
Practice Teaching	(1)	Practice Teaching (1)

FIRST TERM	SENIOR YEAR	SECOND TERM
Special Method	(1) or (2)	Special Method (1) or (2)
Practice Teaching	(2)	Problems of Secondary Education (3)
Educational Psychology (advanced)	(3)	Practice Teaching (2)

While all these courses are ordinarily given each year, it should be understood that to secure the Provisional College Certificate to teach in Pennsylvania High Schools a student need complete only Introduction to Teaching, Educational Psychology, for which General Psychology is a prerequisite, Practice Teaching, and two of the following: Principles of Secondary Education, Special Method, History of Education, Problems of Secondary Education, School Efficiency, and Advanced Educational Psychology.

Through the courtesy and public spirit of the Boards of Education, Superintendents of Schools, and principals and teachers of the neighboring high schools, the plan of practice teaching outlined under course 16 has worked out well. These schools provide not only modern well equipped buildings but also excellent organization and teachers well fitted to serve as models and critic teachers for students in education. The students of Lehigh University are cordially welcomed, and have abundant opportunity for observation, with some facilities for practice.

Students who expect to teach upon graduation are urged to get in touch with the Department of Education early in their college career. The proper selection of studies is of great im-

portance to future success, and by the beginning of the sophomore year the student should, if possible, decide upon one subject for his specialty and a second subject, preferably though not necessarily related to the first, for a second string to his bow. While the State requires only that twelve semester hours be given to each subject in which the applicant will be certificated, it is safe to say that the specialty should receive not much less than twice this amount of attention.

It is desirable that during the junior year the student should secure the thorough review of the elements of his specialty that is furnished by the courses in Special Method. The best practice teaching cannot be done by a man who is weak in the fundamentals of his subject through lack of recent review.

The department has prepared a "self-estimate" card, which enumerates the qualities that are most important in a teacher and some of the defects that are most dangerous. The student is encouraged to rate himself, and to study how to make the most of his talents and how to remedy his defects. Appearance and manner, the use of English, self-control, interest in and sympathy with other people and especially with the young, physical health, interest in the sports and other activities of high school students, ideals of scholarship, loyalty, and co-operation, professional purpose—these are some of the personal elements which a student who hopes to teach is invited to study in this way.

Whether in large or small high schools, the young teacher often finds opportunity to guide his pupils in wholesome sport and recreation. The Department of Physical Education is giving to students training that should greatly add to their value in the teaching profession. A list of the courses offered is given on pages 140 and 141.

THE COLLEGE OF BUSINESS ADMINISTRATION

The first function of the College of Business Administration is to provide for students intending to enter business rather than the professions thorough training in the principles which underlie all business activity. With this end in view the College offers to students meeting the entrance requirements outlined on page 21 a complete four-year curriculum leading to the degree of Bachelor of Science in Business Administration. The curriculum covers the fundamental economic principles that control the growth and operation of industrial and commercial enterprises, the general laws that determine prosperity and economic progress, and the basic facts of accounting, finance, and statistics that are applicable to all business.

The curriculum is not intended to equip students for the management of enterprises or the holding of responsible business positions immediately after graduation. The College of Business Administration makes no attempt to provide a substitute for the training and experience in the complex details of any particular business that can be gained only from actual contact with that business. The primary aim is to develop in the student an intelligent understanding of forces and principles, an ability to analyze industrial and commercial phenomena, and a habit of thought that will enable him in later life to cope with the practical problems increasing executive responsibility will bring. Above all, the course is intended to give the student such familiarity with various types of business that he can intelligently choose the special branch in which he is most likely to succeed, without trusting to the fortuitous hazards of personal connections and opportunity.

The course is so arranged that the freshman year is largely devoted to the work in mathematics, English, and foreign languages which is essential as a background for the specialized work of the succeeding years. The sophomore year takes up the work in economic theory and accounting principles which is fundamental to any understanding of business. The junior and senior years include advanced work in special and more technical aspects of business, such as banking, corporation management, economic resources, labor problems, statistics, accounting methods, and business law.

A second function of the College of Business Administration is to afford to students in the College of Arts and Science and in the various engineering departments of the University an opportunity to receive instruction in the fundamental facts and principles of economics, now recognized as a necessary part of the curriculum of all college students, whether in the more generalized cultural curricula or in the highly specialized professional engineering fields.

A special service in this connection is the provision of courses in the Curriculum in Industrial Engineering.

THE CURRICULUM IN BUSINESS ADMINISTRATION

Total Hours Required for the Degree of Bachelor of Science: 142

FIRST TERM			FRESHMAN YEAR			SECOND TERM		
<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>		<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>		
English	120	(3)		English	125a	(3)		
French	98	(3)		French	99	(3)		
or German ..	77 or 70			or German ..	77 or 71			
or Spanish ..	110 or 113			or Spanish ..	110 or 113			
or Portuguese ..	116			or Portuguese ..	116			
Industrial Evolution..	38	(3)		Industrial Evolution..	38	(4)		
Unified Math.	156	(3)		Business Math.	154	(3)		
Eng. Drawing	160	(3)		Eng. Drawing	161	(2)		
Mil. Sci.	470	(1½)		Mil. Sci.	470	(1½)		
*Hygiene Lectures..	500a	(¼)		Phys. Ed.	501-9	(½)		
*Phys. Ed.	501-9	(¼)		Chapel	—	(½)		
Chapel	—	(½)		College and Orienta-	—			
College and Orienta-	—			tion Lectures.....	—	(½)		
tion Lectures.....	—	(½)						
			18				18	

FIRST TERM			SOPHOMORE YEAR			SECOND TERM		
<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>		<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>		
Physiography	277	(2)		Physiography	278	(2)		
Accounting	20	(3)		Accounting	20	(3)		
Am. Gov't.	542	(3)		Am. Gov't.	543	(3)		
Economics	16	(3)		Economics	17	(3)		
French	100	(3)		French	101	(3)		
or German ..	78 or 77			or German ..	79 or 77			
or Spanish ..	112 or 115			or Spanish ..	112 or 115			
or Portuguese ..	117			or Portuguese ..	117			
Mil. Sci.	471	(1½)		Mil. Sci.	471	(1½)		
Phys. Ed.	501-9	(½)		Phys. Ed.	501-9	(½)		
Chapel	—	(½)		Chapel	—	(½)		
College Lectures	—	(¼)		College Lectures	—	(¼)		
			16¾				16¾	

FIRST TERM	JUNIOR YEAR	SECOND TERM
Bus. Law 31	(2)	Bus. Law 32 (2)
U. S. Hist. 534	(3)	U. S. Hist. 535 (3)
Labor Legis. 23	} (3)	Labor Legis. 23 (3)
or Adv. Acctg. 21		or Adv. Acctg. 21 (3)
Statistics 26	(3)	Statistics 26 (3)
Ec. Geog. 35	(3)	Ec. Geog. 36 (3)
Psychology 5	(2)	Psychology 6 (2)
Phys. Ed. 501-9	(1)	Phys. Ed. 501-9 (1)
College Lectures—	($\frac{1}{4}$)	College Lectures— ($\frac{1}{4}$)
	<u>17 $\frac{1}{4}$</u>	<u>17 $\frac{1}{4}$</u>

FIRST TERM	SENIOR YEAR	SECOND TERM	
Banking & Currency..27	(3)	Banking & Currency..27	(3)
Sociology 24a	(3)	Sociology 24a	(3)
Phys. Ed. 501-9	(1)	Phys. Ed. 501-9	(1)
<i>Any three of the following:</i>		<i>Any three of the following:</i>	
European Hist. ...524	} (9)	European Hist. 525	} (9)
Political Sci. 544		Comp. Gov. 545	
Corp. Fin. & Inv....25		Corp. Fin. & Inv....25	
Cost Accounting ...21b		Cost Accounting ...21b	
Public Finance 19	(3)	Public Finance 19	(3)
†Free Elective—		†Free Elective—	
	<u>19</u>		<u>19</u>

* Hygiene Lectures, 500a, first three weeks; Physical Education, 501-9, the remainder of the term.

† Any three-hour subject approved by the Head of the Curriculum.

Students may, with the approval of the Faculty, substitute for some of the subjects in the junior and senior years other subjects which will better suit their future aims.

Prospective teachers should in this connection read the statement concerning Courses for Teachers.

THE COLLEGE OF ENGINEERING

THE CURRICULUM IN CIVIL ENGINEERING

The requirements for admission to the curriculum in Civil Engineering are given on page 21.

The purpose of this curriculum is to give a broad education in those general and scientific subjects which form the foundation of all engineering, and a special training in the field of Civil Engineering, which covers the building of highways, railroads, harbors, docks and terminals, bridges, buildings, foundations, subways, tunnels, water supply and purification plants, sewerage systems and sewage disposal plants, together with water power development, and surveying. The Department aims to teach young men how to think and how to attack new problems, to impress upon them the underlying principles of engineering, and to inspire them with the desire to do their best work.

To enable the Civil Engineering graduate to deal with allied engineering problems arising in most Civil Engineering projects of today, the course includes certain special studies such as dynamos and motors, alternating currents, heat engines, metallurgy, mineralogy, and geology. Courses in Business Administration, comprising economics, accounting, business law, and finance, have been placed in the curriculum with the idea that the graduate should have a knowledge of the fundamentals of business. These business subjects should prove useful to young graduates whose advancement may be along sales, managerial, and executive channels. The Civil Engineering curriculum as a whole, including as it does mathematics, pure and applied science, general engineering, and business subjects, affords a thorough training in system, arrangement of work, accuracy in figures, and logical thinking, so that the student has the proper training to enter not only the engineering profession, but also any business organization, should he not care to follow strictly engineering work.

The first two years are devoted to fundamental studies which both give general culture and prepare for the technical work of the following years. These studies include the various branches of pure mathematics, physics, chemistry, English, modern languages, drawing, descriptive geometry, mineralogy, geology, and military science and tactics.

In the summer school, at the close of the sophomore year, Land, Topographic, and Railroad Surveying is given. This covers a period of six weeks, and by this arrangement the attention of students is concentrated upon surveying, thus enabling practical field operations to be exemplified in the best manner. In Geodetic Surveying, given in the senior year, triangulations of a high degree of precision are executed. Determinations of azimuth and adjustments of results are made by standard methods. A large collection of levels, transits, and other surveying instruments enables the student to become familiar with instruments of the best type.

Mechanics of Materials, which presents the theory of beams, columns, and shafts, and the method of computing and designing them, is given in the junior year. The course as here presented may be described as applied mechanics, that is, the application of mechanics to the design of engineering structures. Materials Testing Laboratory, paralleling Mechanics of Materials, is of great importance for the student's understanding of the mechanics of engineering and for the capacity it gives him to manipulate apparatus and to handle machines. Tests are made on the various materials used in construction.

Buildings and bridges receive attention throughout three terms. Analytical and graphic methods of determining stresses are taken up in Roofs and Bridges of the second term of the junior year and in Bridge and Structural Design and Higher Structures of the senior year. Visits are made to bridges and fabricating shops. In the senior year designs and working drawings are prepared by each student for both a highway and a railroad bridge. Some of these drawings are made in the same manner as in drawing rooms of bridge companies and others are general, that is, design drawings only. The theory of cantilever, draw, suspension, and arch structures receives detailed attention. Structural Steel Design as applied to building construction is studied in detail. The design and construction of reinforced concrete and foundations are given in the second term of the senior year in the course in Reinforced Concrete Design and Foundations. This extended training in structural engineering furnishes a foundation for structural steel and reinforced concrete work in practice.

Hydraulic Engineering and Sanitary Engineering are treated at length. The theory of the flow of water through orifices,

weirs, pipes, and channels, together with the principles of hydraulic motors, is given in the junior year, the work being supplemented by testing in the hydraulic laboratory. In the senior year the subjects of water supply, water power, and sewerage are covered in detail. The methods of collecting, purifying, and distributing water are explained and compared; house drainage, the design of sewerage systems, and the disposal of sewage also receive attention. Computations for dams, stand-pipes, sewers, and other appurtenances are made. Canal engineering, river and harbor work, and land drainage are studied; irrigation by both water and sewage are discussed. The training in Hydraulics and Sanitary Engineering subjects, including Sanitary Biology of the senior year, is planned to enable a graduate to enter upon the work of city engineering. In connection with the course in Hydraulics, measurements are made of the flow of the Lehigh River, the Lehigh Canal, and other streams in the vicinity of Bethlehem, and the data thus obtained are studied later and reports written thereon. In view of the increasing importance of water power development this work is of value and interest.

The contents of the courses in Highway Engineering and Railroads are planned to prepare a student to enter the field of highway construction and design and railroad work.

Contracts and Specifications of the second term of the senior year is presented by the Civil Engineering Department more from the engineering than from the legal viewpoint. This course, consisting of two lectures a week, gives the essential features of contracts and the form and scope of contracts and specifications as used in building engineering works.

A description of the Fritz Engineering Laboratory, which is operated by the Civil Engineering Department, is given in this Register under the heading of Buildings.

During the Senior year an inspection trip is made to New York or Philadelphia for the purpose of viewing and studying engineering works, including construction. The trip is required of all students. The minimum expense is about \$25.00.

The student who completes the curriculum receives the degree of Civil Engineer (C.E.). Mature young men, if properly qualified, may take special studies without being candidates for the degree.

THE CURRICULUM IN CIVIL ENGINEERING

Total Hours Required for the Degree of Civil Engineer:

168½ or 169½

FIRST TERM			FRESHMAN YEAR			SECOND TERM		
<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>		<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>		
Adv. Algebra	143	(4)		Pl. Anal. Geom.	145	(3)		
Chemistry	...390 or 393	(2)		Qual. Anal.	395	(2)		
Chem. Lab.	...391 or 393a	(2)		Stoichiometry	397	(1)		
El. Mechanics	320	(3)		El. Mechanics	321	(3)		
French	94	} (3)		Phys. Meas.	322	(1)		
or German	75			French	94	} (3)		
or Spanish	111			or German	75			
English	120	(3)		or Spanish	111			
Mil. Sci.	470	(1½)		English	121	(3)		
*Hygiene Lectures	...500a	(¼)		Drawing	162	(1)		
*Phys. Ed.	501-9	(¼)		Mil. Sci.	470	(1½)		
Chapel	—	(½)		Phys. Ed.	501-9	(½)		
College and Orienta- tion Lectures	—	(½)		Chapel	—	(½)		
				College and Orienta- tion Lectures	—	(½)		
			20				20	

SUMMER TERM: Shop Work or Eng. Const., 8 weeks, with report (3)

FIRST TERM			SOPHOMORE YEAR			SECOND TERM		
Cal. & S. A. Geom.	...146	(4)		Int. Calculus	147	(4)		
Elec. & Mag.	323	(3)		Light and Sound	325	(3)		
M. & H. Lab.	324	(1)		L. E. & M. Lab.	326	(1)		
Mineralogy	266	(4)		Gen. Geology	268	(2)		
Eng. Drawing	163	(3)		Geol. Lab.	269	(2)		
Heat Engines	221	(3)		Heat Engines	222	(3)		
Mil. Sci.	471	(1½)		Eng. Drawing	164	(2)		
Phys. Ed.	501-9	(½)		Mil. Sci.	471	(1½)		
Chapel	—	(½)		Phys. Ed.	501-9	(½)		
College Lectures	—	(¼)		Chapel	—	(½)		
			20¾	College Lectures	—	(¼)		
							19¾	

SUMMER TERM: Land and Top. Surveying, 4 weeks, 165 (5)
 Railroad Surveying, 2 weeks, 166 (2½)

FIRST TERM			JUNIOR YEAR			SECOND TERM		
Mech. of Mats.	167	(4)		Hydraulics	170	(3)		
Mat. Test. Lab.	168	(1)		Hydr. Lab.	171	(1)		
Anal. Mech.	149	(2)		Roofs & Bridges	172	(4)		
Railroads	169	(4)		Astronomy	150	(3)		
Metallurgy	247	(2)		Alt. Cur.	375	(2)		
Met. Probs.	247a	(1)		Dyn. Lab.	356	(1)		
Dyn. & Motors	354	(2)		Highway Eng.	173	(3)		
Dyn. Lab.	355	(1)		Phys. Ed.	501-9	(1)		
Phys. Ed.	501-9	(1)		College Lectures	—	(¼)		
College Lectures	—	(¼)						
			18¾				18¾	

SUMMER TERM: Shop Work or Eng. Const., 8 weeks, with report, 187 (3)

FIRST TERM	SENIOR YEAR	SECOND TERM
Str. Steel Des.....175	(3)	Higher Structures...182 (3)
Br. Des. Dr.....177	(3)	R. Con. D. & F.....183 (3)
Hyd. & W.P. Engr..179	(4)	Cement Lab. 184 (1)
Geodesy 180	} (3)	San. Engr. 186 (3)
or Pract. Astr.....151		San. Biol. 295 (2)
Econ. for Engrs.....30a	(3)	English 127 (3)
R. R's. & Ter.....181	(3)	or Con. & Spec....185 (2)
Phys. Ed. 501-9	(1)	Econ. for Engrs.....30a (3)
		Phys. Ed. 501-9 (1)
	20	18 or 19

* Hygiene Lectures, 500a, first three weeks; Physical Education, 501-9, the remainder of the term.

THE CURRICULUM IN MECHANICAL ENGINEERING

The requirements for admission to the Curriculum in Mechanical Engineering are given on page 21.

The purpose of this course is to give young men a broad and thorough training in the fundamental subjects which underlie all engineering.

The freshman year is given to fundamental studies in preparation for the technical work of the following years and to studies of general cultural value. The former comprise Advanced Algebra, Analytic Geometry, Elementary Chemistry with laboratory exercises, Qualitative Analysis, Stoichiometry, Elementary Mechanics, Heat, and laboratory work in Physical Measurements. The general studies are English, Military Science and Tactics, and modern languages—French, German, or Spanish. Students continue the language accepted for entrance.

At the close of the freshman year, students spend eight weeks in an industrial plant and hand in a report at the beginning of the sophomore year.

In the sophomore year the following courses are given: Differential Calculus, Solid Analytic Geometry, Integral Calculus, Electricity and Magnetism, Light and Sound, Mechanism, Mechanical Drawing, Elementary Machine Design, and Steam Engines. The laboratory course covers mechanics, heat, light, electricity, and magnetism. Military Science and Tactics is continued.

At the close of the sophomore year students are required to spend eight weeks in an industrial plant and to hand in a report at the beginning of the junior year.

The courses given in the junior year are Differential Equations, Analytic Mechanics, Mechanics of Materials, Graphic Statics of Mechanisms, Advanced Electricity and Magnetism, Heat Engines, Hydraulics, Metallurgy, Graphic Statics of Structures, Surveying, and Dynamos and Motors. Courses are given in Engineering Laboratory and Electrical Laboratory; laboratory courses also accompany the study of Mechanics of Materials and Hydraulics.

At the close of the junior year students are required to spend at least eight weeks on student apprenticeship work, shop work, or engineering construction as approved by the Department. A report is required.

The courses of the senior year are Machine Design, Alternating Currents and Electrical Engineering, both accompanied by laboratory work, Mechanical Engineering, English, Economics for Engineers, and Engineering Laboratory. A thesis is required.

The course in Mechanical Engineering is built upon the work of the sophomore and junior years and consists of Thermodynamics, Steam Turbines, Internal Combustion Engines, Air Machinery, Pumping Machinery, and Refrigeration.

The course in Economics for Engineers comprises the elements of Economics, Accounting, Business Law, and Finance.

Instruction in Machine Design is given throughout the sophomore year. There is a thorough drill in projection drawing. Freehand sketches are first made and measurements taken of machine pieces; these sketches are then converted into full-sized drawings. There is considerable practice in the interpretation of such drawings. This is followed by difficult projections and intersections and exercises in the proportioning of machine parts. Both empirical and rational formulas are used to determine the dimensions of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers and connecting rods, the data being given as they would arise in practice. In their senior year the students undertake the calculations, estimates, and working drawings involved in the design of simple but complete machines, the general plan of arrangement being given in the form of rough sketches, photographs, or wood cuts. In the second term the seniors make original designs for simple machinery.

After completing the general course in Physics, students in Mechanical Engineering take courses along electrical lines. The aim is a clear conception of electrical units and a working knowledge of resistance, impedance, reactance, capacity, the magnetism of iron, and the magnetic circuit as used in the construction of electrical machinery. Attention is then directed to the theory and calculation of direct current dynamos,

to the study of variable and alternating current phenomena, and to the theory of the alternating current apparatus. Practical problems show their application. The laboratory work involves tests of resistance, insulation, consumption of energy, and efficiency.

The course in Engineering Laboratory begins with the handling and calibration of the instruments and appliances belonging to the experimental side of mechanical engineering. The simpler tests and experiments are taken up next, and there is a gradual progress toward complex operations such as the complete test of a power plant or pumping station, or a full thermodynamic test of the steam engine. The course is, at present, most fully developed in the field of steam engineering, where it embraces steam calorimetry, flow of steam, the testing of steam traps and separators, of injectors, pumps, and the steam turbine; extensive practice with the indicator, engine tests of various sorts, and boiler testing are included.

Due place is given in the course to gas engineering, tests of gas producers, gas engines, and oil engines, work with compressed air, tests of hot-air engines, and various incidental appliances and apparatus. Dynamometer work includes experiments in friction and lubrication and determination of the efficiency of machines. The purpose of this course is to provide a system of well-selected and graded experiments which will illustrate and impress principles, develop the skill and judgment of the student, and give training in the idea, method, and detail of this sort of work.

In the senior year one trip is taken to New York or Philadelphia, during which visits of inspection are made to power plants, municipal works, ship yards, and a variety of industrial plants located in these cities or the vicinity. This trip is required of all students who are candidates for a degree. The minimum expense is about twenty-five dollars.

Graduates of this curriculum receive the degree of Mechanical Engineer (M.E.).

THE CURRICULUM IN MECHANICAL ENGINEERING

Total Hours Required for the Degree of Mechanical

Engineer: 163

FIRST TERM			FRESHMAN YEAR			SECOND TERM		
<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>		<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>		
Adv. Algebra	143	(4)		Pl. Anal. Geom.	145	(3)		
Chemistry	...390 or 393	(2)		Qual. Anal.	395	(2)		
Chem. Lab.	...391 or 393a	(2)		Stoichiometry	397	(1)		
El. Mechanics	320	(3)		El. Mechanics	321	(3)		
French	94	} (3)		Phys. Meas.	322	(1)		
or German	75			French	94	} (3)		
or Spanish	111			or German	75			
English	120	(3)		or Spanish	111			
Mil. Sci.	470	(1½)		English	121	(3)		
*Hygiene Lectures	..500a	(¼)		Mil. Sci.	470	(1½)		
*Phys. Ed.	501-9	(¼)		Phys. Ed.	501-9	(½)		
Chapel	—	(½)		Chapel	—	(½)		
College and Orienta-		(½)		College and Orienta-		(½)		
tion Lectures	—			tion Lectures	—			
		20				20		

SUMMER TERM: Work in Industrial Plant, 8 weeks, with report (3)

FIRST TERM			SOPHOMORE YEAR			SECOND TERM		
Cal. & S. A. Geom.	...146	(4)		Int. Calculus	147	(4)		
M. & H. Lab.	324	(1)		Light and Sound	...325	(3)		
Elec. & Mag.	323	(3)		L., E. & M. Lab.	...326	(1)		
Dr. & El. M. Des.	...200	(3)		El. Mach. Des.	...203	(3)		
Heat Eng.	201	(3)		Heat Eng.	204	(3)		
Mechanism	202	(3)		Mechanism	205	(3)		
Mil. Sci.	471	(1½)		Mil. Sci.	471	(1½)		
Phys. Ed.	501-9	(½)		Phys. Ed.	501-9	(½)		
Chapel	—	(½)		Chapel	—	(½)		
College Lectures	—	(¼)		College Lectures	—	(¼)		
		19¼				19¼		

SUMMER TERM: Work in Industrial Plant, 8 weeks, with report, 227 (3)

FIRST TERM			JUNIOR YEAR			SECOND TERM		
Diff. Equations	...148	(1)		Metallurgy	247	(2)		
Anal. Mech.	149	(2)		Met. Prob.	247a	(1)		
Mech. of Mat.	...167a	(3)		Hydraulics	170a	(2)		
Mat. Test. Lab.	...168	(1)		Hyd. Lab.	171	(1)		
Gr. St. of Mech.	...206	(2)		Gr. St. & Sur.	...174	(3)		
Adv. Elec. & Mag.	...327	(2)		Dyn. & Mot.	354	(2)		
Elec. Lab.	328	(1)		Elec. Lab.	329	(1)		
Heat Eng.	207	(4)		Heat Eng.	209	(4)		
Engr. Lab.	208	(1)		Engr. Lab.	210	(1)		
Phys. Ed.	501-9	(1)		Phys. Ed.	501-9	(1)		
College Lectures	—	(¼)		College Lectures	—	(¼)		
		18¼				18¼		

SUMMER TERM: Student Apprenticeship or Engineering Construction or Shop Work, 8 weeks, with report, 228 (3)

FIRST TERM	SENIOR YEAR	SECOND TERM
English 127	(3)	Mach. Design 215 (4)
Mach. Design 211	(4)	Elec. Engr. 361 (2)
Alt. Currents 375	(2)	Dyn. Lab. 356 (1)
Dyn. Lab. 355	(1)	Econ. for Engrs.....30a (3)
Econ. for Engrs.....30a	(3)	Mech. Engr. 216 (4)
Mech. Engr. 212	(4)	Engr. Lab. 217 (1)
Engr. Lab. 213	(1)	Thesis 214 (3)
Phys. Ed. 501-9	(1)	Phys. Ed. 501-9 (1)
	19	19

* Hygiene Lectures, 500a, first three weeks; Physical Education, 501-9, the remainder of the term.

THE CURRICULUM IN METALLURGICAL ENGINEERING

The requirements for admission to the Curriculum in Metallurgical Engineering are given on page 21.

The object of this curriculum is the preparation of the student for practice in the general field of metallurgy. It is recognized that the breadth of the subject is such that detailed instruction in any particular subdivision is precluded in the time limits imposed by a four-year course. Emphasis is therefore laid on the thorough training of the student in fundamentals, and the course is planned to be as general, fundamental, and broad as the requisite amount of metallurgical training will permit. It is a fairly simple matter for a man thoroughly grounded in fundamental theory to make the necessary applications to actual practice after he gets into the field, but the acquisition of theory to bolster up a purely practical knowledge is a more difficult achievement.

The foundation of any engineering course must be thorough training in mathematics, in chemistry, in physics, in economics, and in the use of English, and one or two foreign languages. The work along these lines is as full as the time available will permit. A large portion of the first two years of the curriculum is devoted to these subjects, while the last two years are given mainly to their application in the various technical subjects and in industry.

Collateral studies in other departments than metallurgy are liberally provided, such as Mineralogy, Blowpiping, General Geology, Geological Practice, and Economic Geology in the Department of Geology; Mechanical Drawing, Surveying, Descriptive Geometry, Mechanics of Materials, and Hydraulics, including laboratory, in the Department of Civil Engineering; Ore Dressing in the Department of Mining Engineering; Advanced Electricity and Magnetism, and Electrical Laboratory in the Department of Physics; Alternating Currents, Dynamos and Motors, Electrical Engineering, and Dynamo Laboratory in the Department of Electrical Engineering; Graphic Statics, Thermodynamics, and Heat Engines, comprising the study of boilers, steam engines, gas engines, and internal combustion motors, and Engineering Laboratory, in the Department of Mechanical Engineering.

Instruction is given in English composition and public speaking. The study of German or French for at least one year is required, the student continuing the language with which he enters; if a student enters with Spanish, he takes one year of German. The one year of either German or French is supplemented in the senior year by a course in reading metallurgical German and French with the staff of the Department of Metallurgy.

The studies in chemistry, which are so important to the metallurgist, include Laboratory Experiments, Qualitative and Quantitative Analysis, both gravimetric and volumetric, of the more common ores and metallurgical products, including Gas Analysis and Assaying, along with courses in Stoichiometry, Advanced Chemistry, Physical Chemistry, and Physical Chemistry Laboratory. This instruction, together with the course in Physics and Physical Laboratory, constitutes the foundation on which the metallurgical instruction is based.

The special instruction in Metallurgy includes lectures on the history of metals, followed by a discussion of their economic and mechanical importance and their physical and chemical properties, including statistics of their production and details concerning the distribution of their ores and the geographical distribution and conditions of their production. Courses of lectures extending over three years take up in detail the general principles of metallurgy and their applications to specific cases. The first course treats of the general physical and chemical principles utilized in extracting metals from their ores and the manner in which they are applied, and is followed by a course on the Metallurgy of Iron and Steel, and by another course on the metallurgy of the other metals, copper, lead, silver, gold, etc., in which each metal is discussed in detail. A course of lectures follows on the principles of electrochemistry and their application in electrometallurgy, accompanied by laboratory investigations of these principles as well as the general principles of metallurgical processes, including methods of making physical and chemical measurements which are of value to the practicing metallurgist. A course in Metallography acquaints the student with the methods of studying, with the microscope and other instruments of precision, the physical properties, constitution, and structure of metals and

alloys. The seminar in the senior year is intended to bring together the members of the Department and the students in the discussion of current metallurgical questions and problems and students' theses, and especially to give facility in presenting data to others in clear, concise, and forceful English. Metallurgical articles in English and foreign languages are abstracted and presented. The student's presentation is good-naturedly criticised by his fellows and instructors.

In order to impress metallurgical principles upon the student's mind and in order to accomplish the most difficult of all teaching achievements, making the student think, the course includes a series of problems dealing with practical details of the metallurgical processes in an exact and quantitative manner, the data whenever possible being taken from every-day commercial practice, so that the results may give an insight into the quantitative relations that are fundamental to all metallurgical processes. The purpose is to train the student in quantitative thinking in metallurgy.

Information is crystallized in the minds of the students by laboratory exercises in which they are required to study the principles of chemical, physical, and mechanical metallurgy. Instruction is given in connection with this laboratory work with the object of teaching and encouraging the practice and application of research in metallurgy. The course is planned to emphasize the principles and subordinate the time-consuming manual operations. The course employs laboratory apparatus and is preliminary to thesis work, during which the students often have to apply the underlying principles they are studying to full-size operations and furnaces in commercial metallurgical works and foundries.

Through the kindness of the officials of the Bethlehem Steel Company, the students spend a total of about 15 to 20 afternoons of three hours each in the steel works, studying the operations in detail under the guidance of instructors, there being not more than six students to each instructor. These visits are co-ordinated with a conference period; the students are informed in advance just what subjects are to be studied during each visit, and are required to report thereon in writing or verbally. Visits of inspection are also made to other metal-

lurgical works and industrial plants, such as smelters and refineries of copper, lead, gold, silver, and zinc. Plants where heat treating of metals and alloys is practiced in an unusually well-developed manner are also visited. Plants visited in 1924-25 included the U. S. Metals Refinery Company, the American Smelting & Refining Company, the By-Product Coke Plant of the Bethlehem Steel Company, the Plants and Research Laboratory of the New Jersey Zinc Company, the Hyatt Roller Bearing Company, the Philadelphia Navy Yard, the Naval Aircraft Factory, and others. The students also spend part of one summer vacation working in a metallurgical plant, but it is believed that employment activity of college students does not give the same facility in applying principles or the same keenness of observation as work under the immediate direction of instructors. In individual cases, however, so-called "industrial co-operative courses" have been arranged for special and graduate students.

Graduates of this Curriculum receive the degree of Metallurgical Engineer (Met.E.).

THE CURRICULUM IN METALLURGICAL ENGINEERING

Total Hours Required for the Degree of Metallurgical Engineer: 164

FIRST TERM			FRESHMAN YEAR			SECOND TERM		
Course Title	Course No.	Cr. Hrs.	Course Title	Course No.	Cr. Hrs.	Course Title	Course No.	Cr. Hrs.
Adv. Algebra	143	(4)	Pl. Anal. Geom.	145	(2)			
Chemistry	...390 or 393	(2)	Qual. Anal.	395	(2)			
Chem. Lab.	...391 or 393a	(2)	Qual. An. Conf.	396	(1)			
El. Mechanics	320	(3)	Stoichiometry	397	(1)			
German	72 or 76	} (3)	Drawing	162	(1)			
or French	94		El. Mechanics	321	(3)			
English	120	(3)	Phys. Meas.	322	(1)			
Mil. Sci.	470	(1½)	German	72 or 76	} (3)			
*Hygiene Lectures.	500a	(¼)	or French	94				
*Phys. Ed.	501-9	(¼)	Mil. Sci.	470	(1½)			
Chapel	—	(½)	Phys. Ed.	501-9	(½)			
College and Orienta-			Chapel	—	(½)			
tion Lectures.	—	(½)	College and Orienta-					
			tion Lectures.	—	(½)			
		20			19			

SUMMER TERM: Practical Experience, 8 weeks, with report (3)

FIRST TERM	SOPHOMORE YEAR	SECOND TERM
Cal. & S. A. Geom....146	(4)	Int. Calculus 147 (4)
Adv. Chem. 398	(3)	Adv. Chem. 399 (3)
Elec. & Mag.....323	(3)	Light and Sound....325 (3)
M. & H. Lab.....324	(1)	L., E. & M. Lab....326 (1)
Gen. Met. 243	(2)	Iron & Steel Met....245 (2)
Met. Prob. 244	(1)	Met. Problems 246 (1)
Drawing 163	(3)	Technical Writing ..127 (3)
Mil. Sci. 471	(1½)	Mil. Sci. 471 (1½)
Phys. Ed. 501-9	(½)	Phys. Ed. 501-9 (½)
Chapel—	(½)	Chapel— (½)
College Lectures—	(¼)	College Lectures— (¼)
	19¼	19¾

SUMMER TERM: Quantitative Analysis, 5 weeks, 403a (3)

FIRST TERM	JUNIOR YEAR	SECOND TERM
N. F. Met. 248	(2)	N. F. Met. 250 (2)
N. F. Met. Probs....249	(1)	N. F. Met. Probs....251 (1)
Mineralogy 266	(4)	Gen. Geology 268 (2)
B. P. Anal.....267	(1)	Geology Lab. 269 (2)
Ore Dr. & Lab....302	(3)	Blowpipe Anal. 267 (1)
Heat Engr. 221	(3)	Dyn. & Mot.....354 (2)
Mech. of Mat.....167a	(3)	Dyn. Lab. 355 (1)
Mat. Test. Lab....168	(1)	Heat Eng. 222 (3)
Phys. Ed. 501-9	(1)	Hydraulics 170a (2)
College Lectures—	(¼)	Hyd. Lab. 171 (1)
		Phys. Ed. 501-9 (1)
		College Lectures— (¼)
	19¼	18¼

SUMMER TERM: Assaying, 4 weeks, 413 (3)

FIRST TERM	SENIOR YEAR	SECOND TERM
Metallography 257	(3)	Met. Lab. 256 (2)
El. Chem. 252	(1)	El. Met. 253 (1)
El. Chem. Lab....255	(1)	Seminar 258 (2)
Seminar 258	(3)	Elec. Engr. 361 (2)
Alt. Currents 375	(2)	Dyn. Lab. 362a (1)
Thermodynamics ..212	(4)	Econ. for Engrs....30a (3)
M. E. Lab.....220	(1)	M. E. Lab.....226 (1)
Econ. for Engrs....30a	(3)	Econ. Geol. 271 (4)
Phys. Ed. 501-9	(1)	Thesis 259 (3)
		Phys. Ed. 501-9 (1)
	19	20

* Hygiene Lectures, 500a, first three weeks; Physical Education, 501-9, the remainder of the term.

THE CURRICULUM IN MINING ENGINEERING

The requirements for admission to the Curriculum in Mining Engineering are given on page 21.

The object of this course is primarily to train a student for practice in the field of mining engineering. It is designed to give him the thorough fundamental training of an engineer and a breadth of education that will enable him readily to undertake work in the various lines of engineering frequently presented to one of his profession.

The course, therefore, places the graduate in the path of a large number of opportunities. Not only will he have had sufficient practice and training to enter upon the field of mining but he can pursue work in which geology and metallurgy play an important part or undertake related engineering projects.

In the freshman year a foundation is laid in the fundamental subjects of mathematics, physics, chemistry, English, and modern foreign languages. The modern language pursued is the one presented for entrance. Lectures are given in physiology and hygiene and also in military science and tactics. Military drill and systematic physical exercise are required. Students who elect the Advanced Course in Military Science and Tactics take the R. O. T. C. Camp at the close of the sophomore year and may substitute it for Assaying.

The course in drawing begins in the second term of the freshman year. A student learns the use of drawing instruments, making tracings and blue prints and drawings of machine parts of simple construction, and solves problems in Descriptive Geometry.

The summer school in Land and Topographic Surveying is held at the close of the freshman year. Mine and Railroad Surveying is conducted partly as an inspection trip in the mining regions; this gives practice in mine and railroad surveying and permits a study of mining operations and mining plants, from which data are secured exemplifying class room work and facilitating the course in Mining Design of the senior year.

The course in chemistry begins in the first term of the freshman year and extends to the end of the sophomore year, with the summer school in Assaying at the end of that year. Beginning with an introduction to general chemical theory and

the elements, supplemented by laboratory work, the subject is continued in Qualitative and Quantitative Analysis. Chemical problems and reactions are taught in Stoichiometry. The instruction includes the analysis of common ores, fuels, gases, and metallurgical products.

The course in Economics for Engineers in the senior year aims to present to the student the several economic, commercial, administrative, and legal aspects of conditions existing in the industrial world which are of particular concern to the engineering profession.

The importance of the conservation of the timber resources of the country and the preservation of wood against decay are treated in Forestry, together with the characteristics of the woods of the important timber species.

Mineralogy is introduced by a short course in Crystallography, in which models of crystals and mineral specimens are studied. The various means of identification are then applied to more difficult minerals, the determination of which may be assisted and effected by the work in Blowpipe Analysis.

In the courses in geology, the student studies the forms and structures of the rock masses of the earth's crust and the forces which modify them. A brief review of historical geology deals with the fossil life of the globe. Practice in Field Geology teaches the methods by which rock formations are accurately mapped. Economic Geology treats of the origin, mode of occurrence, and distribution of the metallic and non-metallic minerals and substances of commercial value in the earth. The course in Petrography enables the student to identify the common rock-forming minerals by the use of the microscope, especially when the constituents are too fine-grained to be determined by the eye alone. Practice in the petrographic and geological laboratory and in the field qualifies the student to recognize the main types of rocks.

Physiography treats of the classification of land forms and their geographical distribution, their relation to geologic structure, weather, and climate, and their influence upon the economic development of countries. The course in Geology of North America discusses the geologic ages and the geographic distribution of the rocks of the continent and their structure and history, and includes studies of the great surveys that have been made. Paleontology reviews the life of past ages and

includes the study and identification of fossils as a means of determining the age of rocks by the principles of stratigraphy.

The course in Heat Engines includes a practical study of boilers, steam and gas engines, and steam turbines; work in the Wilbur Engineering Laboratory includes tests and calculations of efficiencies and powers under varying conditions.

Mechanics of Materials treats of the theories which govern the strength of all kinds of common materials used in construction. Practice is given in computing and designing beams, columns, girders, etc. Hydraulics deals with the flow of liquids through orifices, mains, pipes, and channels, and with the principles of hydraulic motors; practical work in the Fritz Engineering Laboratory is a part of this course. Graphic Statics qualifies the student to compute the forces developed in roof trusses, bridges, and girders by the methods of graphical analysis.

The instruction in Mining Engineering is given during the junior and senior years, under the following subdivisions: prospecting, boring, mining or exploitation, haulage, hoisting, drainage, ventilation, lighting, first-aid, railroads, construction materials, and mine administration. These subjects treat successively of the steps by which minerals are discovered and valued, the manner in which they are extracted from the earth and brought to the surface, the manner in which accidents may occur, means for guarding against them, and the treatment of injured persons, and the means by which mines are maintained in an economical condition from the viewpoint of mine owner and miner.

The subject of Ore Dressing, supplemented by work in the Coxe Mining Laboratory, deals with the processes by which ores and fuels, direct from the mine, are rendered marketable. Construction Materials treats of the materials used in roads and structures in and around mines, particular attention being given to the use of reinforced concrete construction. Mine Administration discusses the method of employing labor and keeping accounts and mining principles and management.

The course in Oil and Gas Technology includes a study of the occurrence and distribution of petroleum and natural gas, the methods of prospecting, the means for obtaining them from the earth, and their storage and transportation.

In Mining Design the student employs principles studied and observations made as the basis for designs and working drawings of parts of mining plants to fulfill given conditions.

In Metallurgy the general principles of the subject, embracing fuels, furnaces, and processes, are presented, followed by the metallurgy of iron and steel, copper, lead, gold, silver, zinc, tin, mercury, nickel, and aluminum. Electrochemistry and Electrometallurgy familiarize the student with the practical applications of electricity to metallurgical processes including electric-furnace practice. Visits of inspection are made to metallurgical plants in the vicinity, and also to those near New York City.

Dynamos and Motors and Alternating Currents extend over the entire senior year and embrace the study of the industrial applications of electricity which are of particular value to the mining engineer; practical work in the Dynamo Laboratory is included in these courses.

Thus the student of the Curriculum in Mining Engineering has studies in all the technical departments of the University, as well as in many of the departments of arts and science.

The facilities for exemplifying the work of the course are exceptional. Cement mills, cement, slate, and other quarries, and ore and coal mines are within easy distance, and in the city are the great works of the Bethlehem Steel Company. During the senior year all students in Mining Engineering are required to make inspection trips to the anthracite coal regions and to the metal mining districts of eastern Pennsylvania and of New Jersey. Two voluntary inspection trips to the mines of the northern central part of the United States and southern Ontario, which included the Lake Superior iron and copper region, were made in the summers of 1922 and 1924. A similar trip may be offered in 1926, but is not guaranteed.

The Department of Mining Engineering has exceptional facilities in the Eckley B. Coxe Mining Laboratory. A description of the Laboratory is given on pages 172 and 173 of this Register.

The expenses of the inspection trips required of all mining students are approximately as follows:

Three Metallurgical one-day trips—\$15.00.

Regular Mine Surveying Trip, one week—\$25.00.

Senior Mining and Geological Inspection Trip, four days—\$25.00.

Voluntary Summer Inspection Trip (by automobile), five weeks—\$150.00.

Graduates of this Curriculum receive the degree of Engineer of Mines (E.M.).

THE CURRICULUM IN MINING ENGINEERING

Total Hours Required for the Degree of Engineer of Mines: 172

FIRST TERM			FRESHMAN YEAR			SECOND TERM		
<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>		<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>		
Adv. Algebra	143	(4)		Pl. Anal. Geom.....	145	(3)		
Chemistry ...	390 or 393	(2)		Qual. Anal.	395	(2)		
Chem. Lab....	391 or 393a	(2)		Stoichiometry	397	(1)		
El. Mechanics	320	(3)		El. Mechanics	321	(3)		
French	94	} (3)		Phys. Meas.	322	(1)		
or German	75			French	94	} (3)		
or Spanish	111			or German	75			
English	120	(3)		or Spanish	111			
Mil. Sci.	470	(1½)		Drawing	300	(2)		
*Hygiene Lectures..	500a	(¼)		Mil. Sci.	470	(1½)		
*Phys. Ed.	501-9	(¼)		Phys. Ed.	501-9	(½)		
Chapel	—	(½)		Chapel	—	(½)		
College and Orienta-		} (½)		College and Orienta-		} (½)		
tion Lectures.....	—			tion Lectures.....	—			
		20				19		

SUMMER TERM: Land and Topographic Surveying, 4 weeks, 165 (5)

FIRST TERM			SOPHOMORE YEAR			SECOND TERM		
<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>		<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>		
Cal. & S. A. Geom...	146	(4)		Int. Calculus	147	(4)		
Quant. Anal.	401	(3)		Quant. Anal.	403	(3)		
Quant. An. Conf....	402	(1)		Quant. An. Conf....	405	(1)		
Elec. & Mag.....	323	(3)		Light and Sound...	325	(3)		
M. & H. Lab.....	324	(1)		L., E. & M. Lab....	326	(1)		
Mineralogy	266	(4)		Gen. Geology	268	(2)		
B. P. Anal.....	267	(1)		Geol. Lab.	269	(2)		
Drawing	300a	(1)		B. P. Anal.....	267	(1)		
Mil. Sci.	471	(1½)		Mil. Sci.	471	(1½)		
Phys. Ed.	501-9	(½)		Phys. Ed.	501-9	(½)		
Chapel	—	(½)		Chapel	—	(½)		
College Lectures	—	(¼)		College Lectures	—	(¼)		
		20¾				19¾		

SUMMER TERM: Assaying, 4 weeks, 304 (3)

FIRST TERM		JUNIOR YEAR		SECOND TERM	
Mining Engr.	301	(4)	Mining Engr.	303	(4)
Ore. Dr. & Lab.	302	(3)	Metallurgy	247	(3)
Mech. of Mat.	167a	(3)	Heat. Eng.	222	(3)
Mat. Test. Lab.	168	(1)	Hydraulics	170a	(2)
Heat Eng.	221	(3)	Hyd. Lab.	171	(1)
Petrography	276	(2)	Mine & R. R. Surv.	304	(3)
Econ. Geol.	270	(2)	Oil & Gas. Tech.	306	(2)
Forestry	291	(2)	English	127	(3)
Phys. Ed.	501-9	(1)	Phys. Ed.	501-9	(1)
College Lectures	—	($\frac{1}{4}$)	College Lectures	—	($\frac{1}{4}$)
		<u>21$\frac{1}{4}$</u>			<u>22$\frac{1}{4}$</u>

FIRST TERM		SENIOR YEAR		SECOND TERM	
Mining Engr.	305	(3)	Mining Des.	307	(3)
N. F. Met.	248	(2)	Econ. Geol.	271	(4)
El. Chem. & Met.	254	(2)	N. F. Met.	250	(2)
Dyn. & Mot.	354	(2)	Alt. Cur.	375	(2)
Dyn. Lab.	355	(1)	Dyn. Lab.	356	(1)
Field Geol.	275	(3)	Geol. N. A.	273	(3)
Graph. Stat.	178	(2)	Engr. Lab.	226	(1)
Econ. for Engrs.	30a	(3)	Mine Ad.	305a	(1)
Engr. Lab.	220	(1)	Econ. for Engrs.	30a	(3)
Phys. Ed.	501-9	(1)	Phys. Ed.	501-9	(1)
		<u>20</u>			<u>21</u>

* Hygiene Lectures, 500a, first three weeks; Physical Education, 501-9, the remainder of the term.

THE CURRICULUM IN ELECTRICAL ENGINEERING

The requirements for admission to the Curriculum in Electrical Engineering are given on page 21.

The object of this curriculum is to give a broad education in those general and scientific subjects which underlie all the branches of engineering, and to give special training in those technical and business subjects which experience shows are most essential in the equipment of the electrical engineer. In seeking to accomplish this object the Department puts chief emphasis upon mastery of principles and thoroughness in the analysis of problems.

The course includes a number of special studies in civil, mechanical, and metallurgical engineering, so that the graduate in Electrical Engineering is prepared not only to enter any of the branches of electrical engineering but also to deal with related problems in the other branches of engineering. The electrical engineering graduate of today finds that professional advancement often lies through commercial, managerial, or executive channels. As superintendent or manager of electric light, power, or railway properties he must be prepared to handle problems involving not merely material and technical details but human relations, touching workmen, capitalists, public utility commissioners, and the public. He must know something of the principles of accounting, economics, business law, and industrial management. A number of such studies have been introduced into the course.

The fundamental studies are given in the early part of the course and include mathematics, physics, chemistry, English, and a continuation of the modern language accepted for entrance. These subjects include the more essential features of a broad education, and they furnish a preparation for the more advanced scientific and technical training to follow.

At the close of the freshman year, students spend not less than eight weeks at work in an electric plant or shop, and hand in a report on the work at the beginning of the sophomore year.

Work in applied electricity is pursued through the sophomore year in the study of Electric Distribution and Dynamos and Motors, with Dynamo Laboratory. The junior and senior years are devoted almost exclusively to advanced technical work.

During each of the vacations following the sophomore and junior years students are required to spend at least eight weeks in an electrical industrial plant or station; a written report on this work is made at the beginning of the next college year.

The study of Electricity and Magnetism constitutes an introduction to the industrial applications of electricity. Electric Distribution makes immediate application of electrical theory to the calculation of lighting and power circuits, the testing of insulation resistance, and similar problems. The study also includes the installation and wiring of electrical machinery, systems of electrical distribution, and outside and interior wiring.

The study of Dynamos and Motors includes the construction, operation, and control of direct current generators and motors, with numerous illustrative problems. The study of dynamo electric machinery is resumed during the senior year in connection with the subjects of Electrical Design and Alternating Current Machinery.

Fundamental subjects in mechanical engineering are required in this curriculum. Machine Design is given throughout the sophomore year. Graphic Statics of Mechanisms deals with graphic methods of determining the forces acting at all points of a machine and with the efficiency of mechanisms. Heat Engines includes the study of steam boilers thermodynamics, steam engines, turbines, and gas engines. Engineering Laboratory is given throughout the senior year.

Important studies in civil engineering are included in this curriculum. Mechanics of Materials is concerned with the theory of beams, columns, and shafts, and the method of computing and designing them; the subject includes practical work in the testing laboratory. Hydraulics, including laboratory practice, treats of hydrostatics and theoretical hydraulics, the flow of water through orifices, weirs, pipes, and channels, naval hydromechanics, and hydraulic motors.

The study of General Metallurgy, Metallurgy of Iron and Steel, and Metallurgical Problems is given during the first term of the sophomore year. Lectures on Electrochemistry and Electrometallurgy are given during the senior year.

Advanced studies in electrical engineering follow the Electric Distribution, Dynamos and Motors, and Electricity and Magnetism of the sophomore year. Advanced Theory of Electricity and Magnetism is devoted to the theory of electrical units and measurements, ferromagnetism, electromagnetism, advanced theory of electrostatics, electric oscillations and waves, the electron theory, and electrolysis. The accompanying laboratory work is devoted to precise electrical measurements and the standardization and calibration of electrical measuring instruments. The Theory of Alternating Currents deals with the problems and methods of measurements which are peculiar to the modern practical applications of alternating currents and with the theory underlying the action of the important types of alternating current machinery and transmission lines. Alternating Current Machinery includes the study of the construction and operation of alternating current generators, motors, transformers, and other apparatus.

The subject of Electrical Engineering deals with the application of physical principles to the solution of problems relating to direct and alternating current circuits and apparatus.

Dynamo laboratory work, beginning in the second term of the sophomore year, is continued for five terms. Instruction is based on a laboratory manual or notes supplemented by individual direction and supervision in the laboratory. The students work individually or in pairs, and make the more important tests on direct and alternating current generators and motors, rotary converters, transformers, and other electrical apparatus. Written reports of all tests made, with curves plotted from the observations and discussion of results, are required. Throughout these courses the student is trained not only to perform the experimental work but also to plan and direct it.

Electrical Design, begun in the first term of the senior year, is pursued throughout the year. It includes the application of electric, magnetic, and mechanical principles to the design of various types of electrical apparatus. The instruction is given by recitations, problems, and drafting.

Electrical Engineering Seminary continues throughout the senior year. The work consists of the presentation before the

class of papers on assigned topics, supplementing the regular work of the class room, and of reports on thesis work. The Department reading-room is supplied with the leading electrical periodicals, American and foreign. One of the principal objects of the Seminary work is to encourage the systematic reading of the current engineering journals.

Dynamo Testing, given by lectures and problems, treats of standard and special methods of making tests on dynamo machines, transformers, and other electrical apparatus.

Electric Stations takes up the location, design, and equipment of stations, the selection of suitable prime movers, generators, switchboards, and other apparatus. The cost of generating electric power and the various systems of determining rates receive consideration. Under Electric Traction are studied the construction, equipment, and operation of different types of electric railways. The recent developments in the application of electric motive power to steam railroad conditions are discussed, and the results of tests are analyzed.

The subject of Electric Power Transmission deals with the various elements constituting a transmission system. It includes a study of the generating plant, the transmission line, and the receiving systems. Special attention is given to the design, construction, and protection of the line. Under the last three subjects are included visits of inspection to electric light and power stations and manufacturing establishments in Bethlehem and elsewhere. Central station tests are made, and reports are required.

Electric Communication deals with telephone and telegraph systems, with special emphasis on matters of radio telegraphy and telephony, including the theory and operation of vacuum tube circuits. The laboratory work given in connection with this course includes the study of telephone transmission over an artificial telephone line and practical tests on the various radio circuits and apparatus.

In the second term of the Senior year four electives are offered, two of which must be chosen to fulfill the requirements of the curriculum. These electives are offered to permit the student to pursue some work along lines for which he may be particularly fitted.

Graduates of this curriculum receive the degree of Electrical Engineer (E.E.).

THE CURRICULUM IN ELECTRICAL ENGINEERING

Total Hours Required for the Degree of Electrical Engineer: 163

FIRST TERM			FRESHMAN YEAR			SECOND TERM		
Course Title	Course No.	Cr. Hrs.	Course Title	Course No.	Cr. Hrs.	Course Title	Course No.	Cr. Hrs.
Adv. Algebra	143	(4)	Pl. Anal. Geom.....	145	(3)			
Chemistry ...	390 or 393	(2)	Qual. Anal.	395	(2)			
Chem. Lab....	391 or 393a	(2)	Stoichiometry	397	(1)			
El. Mechanics	320	(3)	El. Mechanics	321	(3)			
French	94	} (3)	Phys. Meas.	322	(1)			
or German	75		French	94	} (3)			
or Spanish	111		or German	75				
English	120	(3)	or Spanish	111				
Mil. Sci.	470	(1½)	English	121	(3)			
*Hygiene Lectures.	500a	(¼)	Mil. Sci.	470	(1½)			
*Phys. Ed.	501-9	(¼)	Phys. Ed.	501-9	(½)			
Chapel	—	(½)	Chapel	—	(½)			
College and Orienta- tion Lectures.....	—	(½)	College and Orienta- tion Lectures.....	—	(½)			
		<u>20</u>			<u>20</u>			

SUMMER TERM: Work in Electrical Shops or Plants, 8 weeks,
with report (3)

FIRST TERM			SOPHOMORE YEAR			SECOND TERM		
Cal. & S. A. Geom....	146	(4)	Int. Calculus	147	(4)			
Elec. & Mag.....	323	(3)	Light and Sound....	325	(3)			
M. & H. Lab.....	324	(1)	L., E. & M. Lab....	326	(1)			
Elec. Distr.	351	(2)	Dyn. & Motors.....	352	(3)			
Dr. & El. M. Des....	200	(3)	Dyn. Lab.	353	(1)			
Metallurgy	247	(2)	El. Mach. Des.....	203	(3)			
Met. Probs.	247a	(1)	Gr. St. of Mech.....	206	(2)			
Mil. Sci.	471	(1½)	Mil. Sci.	471	(1½)			
Phys. Ed.	501-9	(½)	Phys. Ed.	501-9	(½)			
Chapel	—	(½)	Chapel	—	(½)			
College Lectures	—	(¼)	College Lectures	—	(¼)			
		<u>18¾</u>			<u>19¾</u>			

SUMMER TERM: Work in Electrical Shops or Plants, 8 weeks,
with report, 376 (3)

FIRST TERM			JUNIOR YEAR			SECOND TERM		
Diff. Equa.	148	(1)	Alt. Cur.	359	(2)			
Anal. Mech.	149	(2)	Elec. Engr.	360	(3)			
Alt. Currents	357	(3)	Dyn. Test.	364	(1)			
Dyn. Lab.	358	(1)	Dyn. Lab.	362	(1)			
Elec. Lab.	328	(1)	Elec. Lab.	329	(1)			
Adv. Elec. & Mag....	327	(2)	Hydraulics	170a	(2)			
Mech. of Mat.....	167a	(3)	Hdr. Lab.	171	(1)			
Mat. Test. Lab....	168	(1)	Heat Eng.	222	(3)			
Heat Eng.	221	(3)	English	127	(3)			
Phys. Ed.	501-9	(1)	Phys. Ed.	501-9	(1)			
College Lectures	—	(¼)	College Lectures	—	(¼)			
		<u>18¼</u>			<u>18¼</u>			

SUMMER TERM: Work in Electrical Shops or Plants, 8 weeks,
with report, 376a (3)

FIRST TERM	SENIOR YEAR	SECOND TERM
Alt. Cur. Mach.....363	(4)	Elec. Power Tr.....372 (3)
Dyn. Testing 365	(1)	Elec. Design 370 (2)
Dyn. Lab. 366	(3)	Dyn. Lab. 374 (2)
Elec. Design 367	(2)	Elec. Seminar 373 (1)
Elec. Stations 368	(2)	Engr. Lab. 226 (1)
El. Chem. & Met....254	(2)	Econ. for Engrs.....30a (3)
Engr. Lab. 220	(1)	Phys. Ed. 501-9 (1)
Elec. Seminar 369	(1)	<i>Any two of the following:</i>
Econ. for Engrs.....30a	(3)	Elec. Traction 371
Phys. Ed. 501-9	(1)	Elec. Commun. 373
		Elec. Transients ..379
		Thesis 377
	20	19

* Hygiene Lectures, 500a, first three weeks; Physical Education, 501-9, the remainder of the term.

THE CURRICULUM IN CHEMISTRY

The requirements for admission to the Curriculum in Chemistry are given on page 21.

This curriculum, leading to the degree of Bachelor of Science in Chemistry, offers an education primarily in chemistry, with some training in related sciences. The modern conception of an education in chemistry includes a simultaneous thorough study of physics and mathematics. In addition to these so-called physical sciences, other studies, planned to develop and aid the thought-processes and culture of the student, are embodied in the course. It is believed by many practicing chemists and chemical engineers that an undergraduate course embracing a liberal allotment of study in the humanities is the best preparation for a successful career. Aside from preparation for the life of a professional chemist, the curriculum is well adapted for teachers of chemistry and as a course preliminary to the study of medicine.

This curriculum and the Curriculum in Chemical Engineering are both given under the direction of the Department of Chemistry, and it is readily possible to change from either course to the other at the end of either term of the Freshman year. The entrance subjects required are the same for both curricula (see page 21), and the tuition and laboratory costs are practically the same. Subjects with the same titles in the tabulated curricula (see pages 71 and 77) are given to students in both courses simultaneously and under the same teachers, and are equal in content. Details of chemical subjects are described in the Curriculum in Chemical Engineering.

The study of English is carried through two full years of this curriculum, beginning in the freshman year and being resumed in the junior year, when the student has a more mature appreciation of literary values and of the necessity for clear and forceful expression in speech and writing. French and German receive considerably more attention in the Curriculum in Chemistry than in the Curriculum in Chemical Engineering, both as language tools for the working chemist and in their cultural aspects. Students who enter the University with French continue French through the freshman year, and take up German through the sophomore and junior

years. Those who offer German as an entrance subject continue German through the freshman and sophomore years and study French through the junior year. Students who offer Spanish for entrance take German through the freshman and sophomore years and French through the junior year.

The course in Bacteriology of the senior year is given in the Department of Biology. A short course in Industrial Mineralogy accompanies the course in Assaying. Geology follows in the second term of the junior year.

Economics throughout the junior year and Modern European History through the senior year are given by the Departments of Economics and History. The Department of Economics supervises the Summer Reading in Economics, embracing such subjects as the origins of industry and their relations to science, the economic import of inventions, industrial management, business law and custom, and contracts. It is believed that this course of reading and study under expert guidance will inculcate an appreciation of the profit and pleasure to be derived from a continued interest in history and economics.

Applications of the science of chemistry and the science of physics to industrial chemistry and to chemical engineering are treated in the senior year in the courses called Industrial Chemistry and Industrial Chemistry Laboratory. These courses afford a thorough-going description of numerous manufacturing processes and include the necessary elements of chemical engineering. The industrial development of chemistry in the manufacture of metals is the subject of the various courses in Metallurgy and Electrometallurgy of the upper years. Here again the engineering features of many procedures are explained and receive critical study.

In order to acquaint the student with factory methods and personnel, a required summer term of work in factory or laboratory is set for the vacation following the junior year. Young men of exceptional ability and ambition are encouraged to enroll in subjects given in the University not listed in the Curriculum in Chemistry, subject to Faculty rules.

The foregoing curriculum will serve as an excellent preparation for graduate study; students who desire to go forward to the Master's Degree (M.S.) will find information in regard to the requirements for that degree on page 145 of this Register.

FIRST TERM	SENIOR YEAR	SECOND TERM
Phys. Chem. 419	(3)	Phys. Chem. 421 (2)
Phys. Chem. Lab....420	(1)	Phys. Chem. Lab....422 (1)
Ind. Chem. Lab....412	(3)	Ind. Chem. 415 (3)
Research Chem. ...423	(3)	Research Lab. 424 (2)
N. F. Met.....248	(2)	Ind. Chem. An.....416 (3)
N. F. Met. Probs....249	(1)	Ind. An. Conf.....417 (1)
Bacteriology 296	(2)	San. Chem. Lab....418 (1)
El. Chem. 426	(1)	N. F. Met.....250 (2)
European History...524	(3)	El. Met. 253 (1)
Phys. Ed. 501-9	(1)	Hist. of Chem.....425 (1)
		European History...525 (3)
		Phys. Ed. 501-9 (1)
	20	21

* Hygiene Lectures, 500a, first three weeks; Physical Education, 501-9, the remainder of the term.

THE CURRICULUM IN CHEMICAL ENGINEERING

The requirements for admission to the Curriculum in Chemical Engineering are given on page 21.

This course of study is designed to prepare the student for the profession of chemical engineering in the construction, control, and management of manufacturing establishments which utilize the principles of chemistry and its allied arts. Aside from the primary requirement of chemistry, the modern development of the chemical engineer enforces a thorough knowledge of physics and mathematics, together with a sound understanding of such fundamentals in mechanical and electrical engineering as will make him a discriminating research and operating engineer.

The following descriptions of subjects given in the Department of Chemistry apply as well to these subjects in the Curriculum in Chemistry. (See page 69.)

Elementary Chemistry, begun in the freshman year, in lectures with demonstrations, text-books, and recitations, is supplemented by experiments in the laboratory which develop manipulative skill and make careful observation habitual. An alternative course, less elementary in both class room and laboratory, is given to entering students who have had a considerable training in elementary chemistry.

After this preliminary view of the elements of chemistry, there is developed that deeper insight into the changes of matter which is the particular province of general chemistry. In Advanced Chemistry of the first term in the sophomore year particularly attention is paid to the theories and modern concepts of chemistry, including solution, equilibrium and energy relations of molecules and of atoms, radio-activity, etc.,—a kind of junior physical chemistry of the greatest everyday importance in chemical engineering. Continued through the second term, this subject covers a moderately advanced study of chemical substances and their preparation and properties, together with an elementary consideration of phase rule and of such general applications as the relations underlying desirable properties in alloys, iron and steel, etc.

Organic Chemistry, taught during the entire junior year, familiarizes the student with the simple compounds of carbon, and acquaints him with the usefulness of this branch of chemistry in science, in the chemistry of animal and plant

life, and in the manufacture of such chemical products as dyes, drugs and medicines, oils, fats, waxes, and many others.

A course of lectures of two hours a week on Advanced Organic Chemistry is offered in the first half of the senior year to students who have shown marked ability in the Organic Chemistry and Organic Chemistry Laboratory of the junior year. This course is available for credit to graduate students who have completed a strong undergraduate course.

An introduction to the chemical analysis of substances is given through Qualitative Analysis in the second term of the freshman year. This is a laboratory course, proceeding from the recognition of individual substances to the analysis of more complex solutions and solids. Lectures and recitations elucidate the facts and theories underlying analytical chemistry. The simpler mathematical relations of chemical processes are reviewed under Stoichiometry and are illustrated through many problems solved by the student. Quantitative Chemical Analysis by gravimetric, volumetric, and electrolytic methods follows through the sophomore year and the first term of the junior year, and takes up the analysis of ores, fuels, metallurgical products, commercial chemicals, and by-products. Frequent class room conferences accompany the laboratory work and consider the calculations involved and the scientific foundations of quantitative analysis. The analysis of industrial organic substances and of food-stuffs and drinking and boiler waters is placed in the final term of the senior year, when the student has a better foundation in increasing experience and a broader outlook on the important significance of Industrial Chemistry. At this stage, too, is placed the sampling and analysis of illuminating and heating gas, flue gases, and other special gases.

Fire-assaying of ores and of gold and silver bullion is taught in the summer term after the sophomore year when continuous attention throughout the day can be given to muffles and furnaces. The practice in Assaying is accompanied by an extensive consideration of the calculations and theories involved in the production of mixtures favorable for the work in hand. A course in Industrial Mineralogy is a part of this summer work, and leads to familiarity with about seventy-five minerals of commercial importance. These minerals are studied in their crystalline forms, and also in the forms in

which they often present themselves for final utilization by the chemical engineer.

The laboratory methods of Physical Chemistry and the systematic deeper study of the generalizations of chemistry learned in the sophomore year are reserved for the senior year under Physical Chemistry. Interrelations of the fundamentals of matter and energy are developed under such cognate headings as two-phase and multiphase systems, thermodynamics, gas reactions, mass action, electrochemistry, colloid chemistry, etc. Attention is given to the usefulness of Physical Chemistry in the solution of manufacturing problems in Chemical Engineering.

Intensive instruction in the application of factory methods in Chemical Engineering is likewise placed in the senior year and is grouped under Industrial Chemistry Laboratory and Industrial Chemistry. The processes reviewed are varied; such as transportation of gases, liquids, and solids; grinding and pulverizing; mechanical, hydraulic, and pneumatic separation; evaporation; distillation; filter pressing; centrifuging; autoclaving. The characteristics and adaptability of engineering materials used in apparatus and machines receive full discussion. Selected industries are investigated and explained. Familiarity with manufacture in its scientific and economic aspects is promoted in a special laboratory fitted with industrial apparatus, the student finally submitting full working specifications for a plant designed for the preparation of some industrial product, together with estimates of the cost of raw material and the cost of conversion into the finished product. Lehigh University is fortunately situated in a district abounding in business enterprises which involve chemical engineering, and visits are made to those plants and to factories in the nearby cities of Philadelphia and New York.

In Research Chemistry in the senior year every student is required to solve a novel problem having a scientific basis and is expected to demonstrate some ability as an independent research worker. The research involves an exhaustive search for and study of the literature bearing on the subject in the University Library, including the patent literature. A short course in the History of Chemistry, with individual reading of significant records, co-ordinates the past progress of the science and leads to a nobler pride and an enhanced initiative in the profession which the graduate enters.

Metallurgy and related subjects are taken in the Department of Metallurgy. These give an extensive training in the principles and methods particularly applied to the recovery of metals from their ores, and the manufacture and properties of the industrial products, iron, steel, copper, zinc, lead, nickel, aluminum, mercury, gold, and silver. Drawing is under the direction of the Department of Mining Engineering. Instruction in mechanical engineering, so important to the chemical engineer, is given by the Mechanical Engineering Department. Mechanical Engineering is developed in Heat Engines of the junior year, and in the Engineering Laboratory of the summer term following the junior year, with a continuation of Engineering Laboratory in the senior year. Many of the problems and innovations of chemical engineering demand a more intimate knowledge of the principles and practice of electrical engineering than is given in the general course in physics; this is provided for in the junior year under Dynamos and Motors and Alternating Currents, with their laboratory adjuncts, in the Department of Electrical Engineering. A comprehension of the scope and general methods of Geology and Bacteriology is attained in short courses in these subjects. Bacteriology is a lecture and laboratory course, and a working knowledge of bacteriological methods as applied to water and some industrial products is achieved. The study of German, a necessary tool in current chemistry, is carried by all students in the freshman year.

An approach to problems of business is made in courses given in the College of Business Administration. The full course of lectures in economics as given in the University is placed in the junior year. Related reading is specified as summer work, and an examination in this requirement is held on the first Saturday following the opening of the first term. The summer reading covers such topics as the origins of industry and their relation to science, industrial management, business law and custom, and contracts.

A scientific society is attached to the Department, with a membership of teachers and students, for the presentation of papers, the discussion of current journals, and the entertainment of speakers of note in the profession of chemical engineering.

The degree granted on completion of the curriculum is Chemical Engineer (Ch.E.).

THE CURRICULUM IN CHEMICAL ENGINEERING

Total Hours Required for the Degree of Chemical Engineer: 175

FIRST TERM			FRESHMAN YEAR		SECOND TERM		
<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>			<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>
Adv. Algebra	143	(4)			Pl. Anal. Geom.....	145	(3)
Chemistry ...	390 or 393	(2)			Chemistry	394	(1)
Chem. Lab....	391 or 393a	(2)			Qual. Anal.	395	(3)
El. Mechanics	320	(3)			Qual. An. Conf.....	396	(1)
German	70	(3)			Stoichiometry	397	(1)
English	120	(3)			El. Mechanics	321	(3)
Mil. Sci.	470	(1½)			Phys. Meas.	322	(1)
*Hygiene Lectures..	500a	(¼)			German	71	(3)
*Phys. Ed.	501-9	(¼)			Mil. Sci.	470	(1½)
Chapel	—	(½)			Phys. Ed.	501-9	(½)
College and Orienta-					Chapel	—	(½)
tion Lectures.....	—	(½)			College and Orienta-		
					tion Lectures.....	—	(½)
			20				19

SUMMER TERM: Work in Industrial Shops or Laboratory (3)
 Summer Reading in Economics, 30 (1)

FIRST TERM			SOPHOMORE YEAR		SECOND TERM		
Cal. & S. A. Geom...	146	(4)			Int. Calculus	147	(4)
Adv. Chem.	398	(3)			Adv. Chem.	399	(3)
Quant. Anal.	400	(3)			Quant. Anal.	404	(3)
Quant. Anal. Conf..	402	(2)			Quant. An. Conf....	405	(2)
Elec. & Mag.....	323	(3)			Light and Sound...	325	(3)
M. & H. Lab.....	324	(1)			L., E. & M. Lab....	326	(1)
Drawing	300	(1)			Drawing	300	(1)
English	123	} (3)			Mil. Sci.	471	(1½)
or German	73				Phys. Ed.	501-9	(½)
Mil. Sci.	471	(1½)			Chapel	—	(½)
Phys. Ed.	501-9	(1)			College Lectures ...	—	(¼)
Chapel	—	(½)					
College Lectures	—	(¼)					
			22¾				19¾

SUMMER TERM: Assaying and Industrial Mineralogy, 4 weeks, 414 (3)
 Summer Reading in Economics, 30 (1)

FIRST TERM			JUNIOR YEAR		SECOND TERM		
Quant. Anal.	406	(2)			Org. Chem.	410	(4)
Quant. An. Conf....	407	(1)			Org. Chem. Lab....	411	(3)
Org. Chem.	408	(3)			Iron & Steel.....	245	(2)
Org. Chem. Lab....	409	(2)			I. & S. Probs.....	246	(1)
Dyn. & Mot.....	354	(2)			Alt. Cur.	375	(2)
Dyn. Lab.	355	(1)			Dyn. Lab.	356	(1)
Gen. Met.	243	(2)			Heat Eng.	224	(3)
Met. Prob.	244	(1)			Economics	17	(3)
Heat Eng.	223	(3)			Phys. Ed.	501-9	(1)
Economics	16	(3)			College Lectures ...	—	(¼)
Phys. Ed.	501-9	(1)					
College Lectures	—	(¼)					
			21¼				20¼

SUMMER TERM: Engineering Laboratory, 4 weeks, 225 (3)
 Summer Reading in Economics, 30 (1)

FIRST TERM		SENIOR YEAR		SECOND TERM	
Phys. Chem.	419	(3)	Phys. Chem.	421	(2)
Phys. Chem. Lab....	420	(1)	Phys. Chem. Lab....	422	(1)
Ind. Chem. Lab....	412	(3)	Ind. Chem.	415	(3)
Research Chem.	423	(2)	Research Lab.	424	(2)
N. F. Met.....	248	(2)	Ind. Chem. An.....	416	(3)
N. F. Met. Probs....	249	(1)	Ind. An. Conf.....	417	(1)
Engr. Lab.	220	(1)	San. Chem. Lab....	418	(1)
Bacteriology	296	(2)	Hist. of Chem.....	425	(1)
El. Chem.	426	(1)	N. F. Met.....	250	(2)
El. Chem. Lab.....	427	(1)	El. Met.	253	(1)
English	137	(1)	Engr. Lab.	226	(1)
Phys. Ed.	501-9	(1)	Gen. Geol.	268	(2)
			Phys. Ed.	501-9	(1)
		19			21

* Hygiene Lectures, 500a, first three weeks; Physical Education, 501-9, the remainder of the term.

THE CURRICULUM IN MARINE ENGINEERING AND TRANSPORTATION

By action of the Board of Trustees the Curriculum in Marine Engineering and Transportation will be discontinued at the close of the academic year 1924-25.

The requirements for admission to the curriculum in Marine Engineering and Transportation are given on page 21.

The purpose of this curriculum is to prepare men to engage in the design, construction, and operation of ships, and to enter the field of marine transportation. The curriculum is a combination of engineering and economics preceded by the fundamental subjects common to engineering curricula: chemistry, modern languages, physics, and mathematics. Combining, as it does, engineering training with studies in economics and business administration, such a course offers great advantages. It has been planned to develop a class of men who, in addition to a knowledge of conditions governing ocean and inland water transportation, will have a command of the technical, economic, and financial problems of ship design, construction, and operation.

The first and second years are devoted largely to physics, modern languages, chemistry, engineering drawing, and mathematics, all of which afford necessary preparation for the technical work in later years.

The second-year schedule, although largely concerned with science, embraces some preliminary work in engineering and economics. There is a detailed study of ship construction, including lectures and recitations, and also work in the drawing room where drawings of ship construction are worked up by the student. In the second term the student fairs up a set of ship's lines. Both the transverse and longitudinal types of construction are given full treatment in this course.

The junior year includes these fundamental engineering subjects: Mechanics of Materials, Hydraulics, Naval Architecture, Heat Engineering, and Astronomy and Navigation. Class room work in most of the subjects is supplemented by exercises in the laboratories. In the first term of the third

year a study is made of the theory of heat engineering and thermodynamics. This course is followed in the second term by a study of marine engineering with special emphasis on the types of propelling machinery, the layout of the marine power plant, and economic problems in marine engineering.

In the senior year the student takes up Ship Design, Marine Engines, Turbines, Diesel Engines, Structural Steel Design, Electrical Engineering, Economics, and Marine Transportation. For those who desire further work in foreign languages, an opportunity is given in the senior year for the study of Spanish.

An important feature of the Lehigh Curriculum in Marine Engineering and Transportation is the large amount of time devoted to the study of economics and allied subjects. To arouse the student's interest and to fit him for work in marine transportation and foreign trade, instruction in Economics and Economic Geography is given in the sophomore year, followed by Accounting and Finance in the junior year, and by Foreign Trade, Marine Insurance, and Admiralty Law in the senior year.

Surveying is given during four weeks of the summer term immediately following the close of the freshman year.

Students are required to do summer work in shipyards and on shipboard, and the department co-operates in finding positions for them. The summer following the sophomore year is spent in a shipyard. This brings the student into direct contact with practical ship construction and shipyard practices, so that he unconsciously acquires a knowledge of the proportions and dimensions of engineering structures. The summer following the junior year is spent at sea so that the student may observe the action of a ship at sea and study the operation of the ship's power plant.

Graduates of this course receive the degree of Marine Engineer (Mar.E.).

THE CURRICULUM IN MARINE ENGINEERING AND TRANSPORTATION

Total Hours Required for Degree of Marine Engineer: 163 or 164

FIRST TERM			FRESHMAN YEAR			SECOND TERM		
Course Title	Course No.	Cr. Hrs.	Course Title	Course No.	Cr. Hrs.	Course Title	Course No.	Cr. Hrs.
Adv. Algebra	143	(4)	Pl. Anal. Geom.	145	(3)			
Chemistry	...390 or 393	(2)	Qual. Anal.	395	(2)			
Chem. Lab.	...391 or 398a	(2)	Stoichiometry	397	(1)			
El. Mechanics	320	(3)	El. Mechanics	321	(3)			
French	94	} (3)	Phys. Meas.	322	(1)			
or German	75		French	94	} (3)			
or Spanish	111		or German	75				
English	120	(3)	or Spanish	111				
Mil. Sci.	470	(1½)	English	121	(3)			
*Hygiene Lectures.	500a	(½)	Drawing	162	(1)			
*Phys. Ed.	501-9	(¾)	Mil. Sci.	470	(1½)			
Chapel	—	(½)	Phys. Ed.	501-9	(½)			
College and Orienta-			Chapel	—	(½)			
tion Lectures.	—	(½)	College and Orienta-					
			tion Lectures.	—	(½)			
		20			20			

SUMMER TERM: Land and Topographic Surveying, 3 weeks, 165 (3)

FIRST TERM	SOPHOMORE YEAR	SECOND TERM
Cal. & S. A. Geom...146	(4)	Int. Calculus 147 (4)
Elec. & Mag.....323	(3)	Light and Sound....325 (3)
M. & H. Lab.....324	(1)	L., E. & M. Lab.....326 (1)
Metallurgy 247	(2)	Econ. Geog. 35 (3)
Met. Prob. 247a	(1)	Ship Constr. 451 (4)
Engr. Drawing 163	(3)	Economics 17 (3)
Ship Constr. 450	(2)	Mil. Sci. 471 (1½)
Economics 16	(3)	Phys. Ed. 501-9 (½)
Mil. Sci. 471	(1½)	Chapel— (½)
Phys. Ed. 501-9	(½)	College Lectures ...— (¼)
Chapel—	(½)	
College Lectures—	(¼)	
	21¾	20¾

SUMMER TERM: Work in Shipyard on Hull Construction, 8 weeks,
with report, 458 (3)

FIRST TERM		JUNIOR YEAR		SECOND TERM	
Mech. of Mat.	167	(4)	Hydraulics	170	(3)
Mat. Test. Lab.	168	(1)	Hyd. Lab.	171	(1)
Naval Arch.	452	(3)	Naval Arch.	453	(4)
Astronomy	150	(3)	Navigation	153	(2)
Heat Engr.	218	(3)	Marine Engr.	454	(4)
Accounting	20	(3)	Finance	18	(2)
Phys. Ed.	501-9	(1)	Phys. Ed.	501-9	(1)
College Lectures	—	($\frac{7}{4}$)	College Lectures	—	($\frac{7}{4}$)
		<u>18$\frac{1}{4}$</u>			<u>17$\frac{3}{4}$</u>

SUMMER TERM: At Sea, 8 weeks, with report, 458 (3)

FIRST TERM	SENIOR YEAR	SECOND TERM
Ship Design 455	(3)	Ship Design 456 (3)
Marine Engr. 460	(3)	Ship Operation 459 (2)
Str. Steel Des. 176	(3)	Mech. Eng. 219 (2)
Engr. Lab. 220	(1)	Engr. Lab. 226 (1)
Admiralty Law 32a	(2)	Foreign Trade 29 (3)
or Spanish 110	(3)	English 127 } (3)
Dyn. & Mot. 354	(2)	or Spanish 110 }
Dyn. Lab. 355	(1)	Alt. Cur. 375 (2)
Term. Facilities 457	(2)	Dyn. Lab. 356 (1)
Phys. Ed. 501-9	(1)	Phys. Ed. 501-9 (1)
	18 or 19	18

* Hygiene Lectures, 500a, first three weeks; Physical Education, 501-9, the remainder of the term.

THE CURRICULUM IN ENGINEERING PHYSICS

The recent growth and expansion of industrial research laboratories, in which methods and apparatus are investigated and developed for engineering application, has caused a large demand for young men capable of attacking the problems arising in these laboratories. The aim of the Curriculum in Engineering Physics is to provide the training necessary for this kind of work; it also provides a training which will prepare young men eventually to follow a career in pure science.

To accomplish this aim, the curriculum includes a thorough grounding in physics, both experimental and theoretical; a comprehensive course in mathematics; elective courses in purely engineering subjects; and elective courses of a broadening and cultural nature, which are felt to be important in the education of this type of engineer.

The freshman year is largely devoted to mathematics, mechanics, chemistry, and English, the fundamentals of all engineering. Modern language and engineering drawing are also included, as is a course in Physical Measurements, in which the student learns the technique of handling simple apparatus, curve plotting, and the orderly recording of data.

In the sophomore year, mathematics is continued through Integral Calculus. Elementary Physics is taught throughout the year by recitations, lectures, and laboratory work. As an introduction to modern physics, a course of lectures and recitations, giving a non-mathematical account of the modern views concerning such subjects as the nature of matter, radio-activity, X-rays, etc., is included in both terms.

The course in drawing given in the first term provides an introduction to the descriptive geometry of projections, intersections, and developments. The second term contains a course in Dynamos and Motors accompanied by laboratory exercises, introducing the student to the engineering viewpoint in electricity. Two credit hours of electives in subjects other than physics are offered.

During the summer the student must spend at least eight weeks as an employee in an industrial research laboratory or

at the Bureau of Standards, and he must prepare and hand in a report on this work at the beginning of the junior year.

In the junior year, a course is given which serves as an introduction to Mathematical Physics and is intended to show the application of Advanced Calculus and Differential Equations to Physics. Topics are selected from Mechanics, Thermodynamics and the Kinetic Theory of Gases, the Wave Theory of Light, and the Theory of Electricity and Magnetism. A laboratory course of a more advanced nature than those given in the freshman and sophomore years runs parallel throughout the year to the above selected topics. Mathematics is continued by an introductory course, including Vector Analysis, Partial Differential Equations, Fourier's Series, and Spherical and Zonal Harmonics. Five credit hours of electives in electrical, mechanical, or chemical engineering subjects and three credit hours in cultural subjects are taken throughout the year.

Summer work for eight weeks at an industrial research laboratory or at the Bureau of Standards is required, and the report on this work is handed in at the beginning of the senior year.

In the senior year, eight credit hours are devoted to Advanced Physics, including Advanced Theory of Electricity and Magnetism, Electric Oscillations, Electric Waves, and High Frequency Measurements; Physical Optics and Spectroscopy, including the theoretical and experimental study of Diffraction, Dispersion and Interference, Polarization, and Modern Spectroscopy; Electron Discharge through Gases, including the properties of Electrons, Gaseous Ions, Thermionic and Photo-electric Measurements; Heat, Thermodynamics, and Heat Radiations. All of these topics are accompanied by advanced laboratory work, the students being assigned laboratory problems of such nature as to train them in the methods of original research.

A thesis is prepared during the senior year to supplement and amplify one of the four courses in Physics offered in that year. The purposes of the thesis are to stimulate independence and originality and to instruct the students in the general method of attacking a laboratory problem and of looking up

scientific literature. In order that a student may become familiar with the method of making laboratory tests in industrial engineering, a course in Engineering Laboratory is given throughout the year. The cultural and broadening studies offered in the junior year are continued as electives in both terms.

Graduates of this course receive the degree of Bachelor of Science (B.S.) in Engineering Physics.

THE CURRICULUM IN ENGINEERING PHYSICS

*Total Hours Required for Degree of Bachelor of Science in
Engineering Physics: 154*

FIRST TERM			FRESHMAN YEAR			SECOND TERM		
<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>	<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>	<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>
Adv. Algebra	143	(4)	Pl. Anal. Geom.....	145	(3)			
Chemistry ...	390 or 393	(2)	Qual. Anal.	395	(3)			
Chem. Lab....	391 or 393a	(2)	El. Mechanics	321	(3)			
El. Mechanics	320	(3)	Phys. Meas.	322	(1)			
French	94	} (3)	Drawing	162	(1)			
or German	75		French	94	} (3)			
English	120	(3)	or German	75				
Mil. Sci.	470	(1½)	English	121	(3)			
*Hygiene Lectures..	500a	(¼)	Mil. Sci.	470	(1½)			
*Phys. Ed.	501-9	(¼)	Phys. Ed.	501-9	(½)			
Chapel	—	(½)	Chapel	—	(½)			
College and Orienta- tion Lectures.....	—	(½)	College and Orienta- tion Lectures.....	—	(½)			
		20			20			

SUMMER TERM: Industrial Work, 8 weeks, with report, (3).

FIRST TERM			SOPHOMORE YEAR			SECOND TERM		
<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>	<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>	<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>
Cal. & S. A. Geom...	146	(4)	Int. Calculus	147	(4)			
Physics	323	(3)	Physics	325	(3)			
Physics	332	(2)	Physics	332	(2)			
Phys. Lab.	324	(1)	Phys. Lab.	326	(1)			
Drawing	163	(3)	Dyn. & Mot.....	354	(2)			
French	100	} (3)	Dyn. Lab.	355	(1)			
or German	78		Electives	—	(2)			
Mil. Sci.	471	(1½)	Mil. Sci.	471	(1½)			
Phys. Ed.	501-9	(½)	Phys. Ed.	501-9	(½)			
Chapel	—	(½)	Chapel	—	(½)			
College Lectures	—	(¼)	College Lectures	—	(¼)			
		18¾			17¾			

SUMMER TERM: Work in an Industrial Research Laboratory or the Bureau of Standards, 8 weeks, with report (3)

FIRST TERM	JUNIOR YEAR	SECOND TERM
Mathematics—	(3)	Mathematics— (3)
Physics 333	(3)	Physics 333 (3)
Physics 334	(2)	Physics 334 (2)
Engr. Electives—	(5)	Engr. Electives— (5)
†Electives (cultural) —	(3)	†Electives (cultural) — (3)
Phys. Ed. 501-9	(1)	Phys. Ed. 501-9 (1)
College Lectures—	($\frac{1}{4}$)	College Lectures— ($\frac{1}{4}$)
	<u>17 $\frac{1}{4}$</u>	<u>17 $\frac{1}{4}$</u>

SUMMER TERM: Work in an Industrial Research Laboratory or the Bureau of Standards, 8 weeks, with report (3)

FIRST TERM	SENIOR YEAR	SECOND TERM
Physics 335	(3)	Physics 339 (3)
Physics Lab. 336	(1)	Physics Lab. 340 (1)
Physics 337	(3)	Physics 341 (3)
Physics Lab. 338	(1)	Physics Lab. 342 (1)
Engr. Lab. 213	(1)	Engr. Lab. 217 (1)
Thesis 343	(4)	Thesis 343 (4)
†Electives (cultural) —	(3)	†Electives (cultural) — (3)
Phys. Ed. 501-9	(1)	Phys. Ed. 501-9 (1)
	<u>17</u>	<u>17</u>

* Hygiene Lectures, 500a, first three weeks; Physical Education, 501-9, the remainder of the term.

† In choosing electives the Head of the Curriculum should be consulted; all selections must be approved by him.

THE CURRICULUM IN INDUSTRIAL ENGINEERING

The University has established a curriculum in Industrial Engineering, to be open to students entering the University in September, 1925. This curriculum is offered with a view to meeting the needs of students who desire the scientific and technical training offered by an engineering curriculum, but who intend to enter the administrative or financial departments of industrial enterprises rather than the strictly technical ones and who wish, therefore, to supplement their engineering work with training in business administration and finance.

The curriculum provides, accordingly, a combination of engineering and business courses designed to give the student thorough training in the fundamentals of engineering and a knowledge of the basic principles which govern industrial management and business practices. It is primarily an engineering curriculum, with emphasis on mechanical and electrical engineering, and will require of the student the ability to master technical work that is called for by other engineering curricula. In addition the student will be required to complete a group of courses in business selected from those which cover the administration of industry, with emphasis on financial, accounting, and employment problems.

The first year is identical with that of the mechanical and electrical engineering curricula. The second year is given over primarily to engineering work. The last two years are devoted in approximately equal proportions to engineering subjects and business subjects.

The requirements for admission, as stated on page 21, are the same as for other engineering curricula. On completion of the four-year curriculum the degree of Bachelor of Science in Industrial Engineering will be awarded.

THE CURRICULUM IN INDUSTRIAL ENGINEERING

*Total Hours Required for Degree of Bachelor of Science in
Industrial Engineering: 165*

FIRST TERM			FRESHMAN YEAR			SECOND TERM		
<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>		<i>Course Title</i>	<i>Course No.</i>	<i>Cr. Hrs.</i>		
Adv. Algebra	143	(4)		Pl. Anal. Geom.	145	(3)		
Chemistry	...390 or 393	(2)		Qual. Anal.	395	(3)		
Chem. Lab.	...391 or 393a	(2)		Stoichiometry	397	(1)		
El. Mechanics	320	(3)		El. Mechanics	321	(3)		
French	94	} (3)		Phys. Measure	322	(1)		
or German	75			French	94	} (3)		
or Spanish	111			or German	75			
English	120	(3)		or Spanish	111			
Mil. Sci.	470	(1½)		English	121	(3)		
*Hygiene Lectures	..500a	(¼)		Mil. Sci.	470	(1½)		
*Phys. Ed.	501-9	(¼)		Phys. Ed.	501-9	(½)		
Chapel	—	(½)		Chapel	—	(½)		
College and Orienta- tion Lectures....	—	(½)		College and Orienta- tion Lectures....	—	(½)		
		20				20		

SUMMER TERM: Work in Industrial Plant, 8 weeks, with report (3)

FIRST TERM			SOPHOMORE YEAR			SECOND TERM		
Cal. & S. A. Geom.	...146	(4)		Int. Calculus	147	(4)		
Elec. & Mag.	323	(3)		Light and Sound	325	(3)		
M. & H. Lab.	324	(1)		L., E. & M. Lab.	326	(1)		
Dr. & El. Mach. Des.	...200	(3)		El. Mach. Des.	203	(3)		
English	123	} (3)		English	127 or 137	} (3)		
or Amer. Govt.	...542			or Amer. Govt.	...543			
Economics	16			Economics	17			
Mil. Sci.	471	(1½)		Mil. Sci.	471	(1½)		
Phys. Ed.	501-9	(½)		Phys. Ed.	501-9	(½)		
Chapel	—	(½)		Chapel	—	(½)		
College Lectures	...—	(¼)		College Lectures	...—	(¼)		
		19¼				19¼		

SUMMER TERM: Work in Industrial Plant, 8 weeks, with report (3)

FIRST TERM			JUNIOR YEAR			SECOND TERM		
Heat Engines	221	(3)		Heat Engines	222	(3)		
Mech. of Mat.	167a	(3)		Dynamos & Motors	...354	(3)		
Mechanism	202	(3)		Mechanism	205	(3)		
Accounting	20	(3)		Accounting	20	(3)		
Money and Banking	...27	(3)		Money and Banking	...27	(3)		
Statistics	—	(3)		Public Finance	—	(3)		
Phys. Ed.	501-9	(1)		Phys. Ed.	501-9	(1)		
College Lectures	...—	(¼)		College Lectures	...—	(¼)		
		19¼				19¼		

SUMMER TERM: Industrial Employment, 8 weeks, with report (3)

FIRST TERM			SENIOR YEAR			SECOND TERM		
Alt. Currents	375	(3)		Elec. Engr.	361	(3)		
Heat Engines	207	(3)		Metallurgy	247	(3)		
Industrial Manag.	...—	(3)		Hydraulics	170a	(3)		
Corp. Finance	25	(3)		Labor Problems	...—	(3)		
Bus. Law	—	(3)		Corp. Finance	25	(3)		
Free elective	—	(3)		Free elective	—	(3)		
Phys. Ed.	501-9	(1)		Phys. Ed.	501-9	(1)		
		19				19		

* Hygiene Lectures, 500a, first three weeks; Physical Education, 501-9, the remainder of the term.

DESCRIPTION OF UNDERGRADUATE COURSES

Following is a complete list of the undergraduate courses offered by the University. The number of exercises a week in each subject is indicated by the figures in parenthesis. Three hours of drawing, three of work in the laboratory, or three of practice in the field are regarded as equivalent to a recitation or lecture of one hour's duration.

PSYCHOLOGY

PROFESSOR HUGHES, MR. WEINLAND, DR. HOFFMAN

1. GENERAL PSYCHOLOGY. Woodworth. For B.A. students. 2 hrs. recitation, 1 hr. laboratory. First term (3).

2. EDUCATIONAL PSYCHOLOGY. Individual differences; analysis of mental traits; learning and memory; how to study; transfer of training; motivation and character building; the psychology of specific activities, as of speech, writing, arithmetic, sport, art, religion. 2 hrs. recitation, 1 hr. laboratory. For B.A. students. *Prerequisite*: 1. Second term (3).

3. ADVANCED EDUCATIONAL PSYCHOLOGY. Practice in administering individual and group tests. Study of administrative applications. Study of classical investigations in the general field covered by course 2, with some first-hand investigation or experiment. *Prerequisite*: 2. First term (3).

4. ELEMENTS OF CLINICAL PSYCHOLOGY. Primarily for seniors in the pre-medical curriculum. Mental disorders and mental hygiene. A series of psychiatric clinics at the State Hospital. The psychology of the emotions and of temperament. *Prerequisite*: 1. Second term (3).

5. PRINCIPLES OF PSYCHOLOGY. For B.S. students. Woodworth. 1 hr. recitation, 2 hrs. laboratory. First term (3).

6. ECONOMIC PSYCHOLOGY. For B.S. students. Problems of personnel, of motivation in industry, and of industrial training. 1 hr. recitation, 2 hrs. laboratory. *Prerequisite*: 1 or 5. Second term (3).

7. EXPERIMENTAL PSYCHOLOGY. A course for seniors who wish to conduct individual studies in some field of psychological experiment. *Prerequisite*: 2 or 6. First or second term (2).

7a. PSYCHOLOGY FOR ENGINEERS. *Applied Psychology*, Hollingworth and Poffenberger. First term (2).

PHILOSOPHY

PROFESSOR HUGHES

8. HISTORY OF PHILOSOPHY. Ancient. A careful study of Plato's *Republic*. Lectures and readings in the great philosophical tradition. First term (3).

9. HISTORY OF PHILOSOPHY. Modern. The rise of modern science, contrasted with Greek thought. Spinoza's *Ethics*. Tendencies in modern thought. Perry's *Present Conflict of Ideals*. Second term (3).

10. LOGIC AND SCIENTIFIC METHOD. Creighton; Libby. Formal logic; the history of scientific method. Modern illustrations. Libby's *Outline of the History of Science*. Second term (3).

10a. ETHICS. The approach to ethics through biology and social psychology. First term (1).

10b. ETHICS. Fullerton. The meaning of virtue, duty, and will. Types of ethical theory. Second term (1).

EDUCATION

ASSISTANT PROFESSOR DROWN, PROFESSOR HUGHES

In this connection the student should study the statement on pages 36 to 38 concerning preparation for teaching.

11. INTRODUCTION TO TEACHING. Adjusting pupils' school and social interests. Introduction of pupil to effective methods of study. Subject matter and method related to technique and routine. Dewey, Earhart, Holley. First term (3).

12. HISTORY OF EDUCATION. The advance of civilization and culture and the parallel progress of educational theory and practice. (1) Evolution of subject-matter; the liberal arts, letters, science, social sciences, the vernacular, vocational and fine arts. (2) Evolution of educational institutions; the university, the college, the secondary and elementary types, the rise of national and state school systems. (3) Educational leaders; how they reflected their times, and their contributions to educational philosophy and practice. Cubberley's *History of Education* and Readings. Second term (3).

13. PRINCIPLES OF HIGH SCHOOL TEACHING. Character and qualifications essential to the high school teacher. The character of the high school student. Types of class exercises in

the high school. Essential factors and devices of high school methods; lesson-planning and the assignment; the question; note-books and reports; reviews and examinations; the laboratory; experimentation and demonstration; the library and source material; problems and projects. Exercises in lesson planning, readings, and observations. First term (3).

14. SCHOOL EFFICIENCY. State and local school systems. Organization of the school. Organization and routine of the class room; management, discipline, supplies, forms, reports; markings, grading, testing, promotion. The external and administrative aspects of teaching. Second term (3).

15. PROBLEMS OF SECONDARY EDUCATION. Secondary education; its historical and comparative aspects; study of German, French, English, and American secondary schools. The social background of American secondary education. The aims, values, and functions of secondary education; analysis of each of the secondary subjects in terms of the same. The personnel of the secondary school. Problems arising out of adolescence; problems arising out of individual differences; problems arising out of economic and social conditions. Articulation with elementary and higher education; the junior high school; the junior college; accrediting and examination systems. Programs of studies; required and elective subjects. Administrative problems. Extra-curricular activities; the teaching staff; the plant and its equipment; costs and finance. Second term (3).

15a. PRACTICE TEACHING. This work is for the most part carried on in the Bethlehem High Schools. The Junior and Senior High Schools of Allentown and Easton also are observed. The work is divided into three approximately equal parts: (1) Observation and report with conference; (2) apprentice work, involving participation in the routine work of the class, conduct of study periods, and correcting of papers; (3) actual conduct of class work, after careful study of lesson plans, followed by systematic criticism by the assisting teacher and by the professors of the department. For students in education in the junior and senior years (2-6).

SPECIAL METHOD. See courses 54, 83, 93, 339.

EDUCATIONAL PSYCHOLOGY. See courses 2 and 3.

ECONOMICS AND BUSINESS ADMINISTRATION

PROFESSORS CAROTHERS AND COWIN,

ASSISTANT PROFESSOR CURTIS, MESSES. CUSTARD AND CROSBY

16. **ECONOMICS.** A study of the elementary principles of economics. Lectures, recitations, and quizzes. First term (3).

17. **ECONOMICS.** A continuation of the work of the first term. Second term (3).

19. **PUBLIC FINANCE.** Government expenditures and their relation to the functions of government and to social, political, and industrial conditions; formulation of budgets; nature and employment of public credit; origin and growth of public debts; revenues from various sources, with reference both to the theory and to the practice of various nations. First and second terms (3).

20. **ACCOUNTING THEORY AND PRACTICE.** A study of the fundamental principles of accounting with sufficient practice work to illustrate these principles. Theories of debit and credit; construction of accounts; interpretation of financial statements; valuation of assets; methods and problems of depreciation. The economic aspects of accounting are emphasized. First and second terms (3).

21. **ADVANCED ACCOUNTING.** Advanced work in the field of accounting practice, with special emphasis on the accounting methods and problems of various types of business organizations. (Elective, junior year.) First and second terms (3).

21b. **COST ACCOUNTING.** (Elective, senior year.) The various systems of manufacturing accounts for different types of manufacturing enterprises; choice of methods to meet peculiar needs; installing cost systems; forms and records; manufacturing accounts as an aid to and as a check on production efficiency; preparation of reports for executives. First and second terms (3).

23. **LABOR LEGISLATION AND ADMINISTRATION.** Labor problems confronting the employer and the more successful methods of meeting them and avoiding legal disputes. The legal status of unions and strikes. Protection of the employer's interests. Employer's Liability and Workmen's Compensation Acts. First and second terms (3).

24a. SOCIOLOGY. A study of the fundamental institutions of society, with special attention to such questions as evolution, economic strata, poverty, marriage and divorce, and social delinquency. First and second terms (3).

25. CORPORATION FINANCE AND INVESTMENTS. A course which in the first term surveys the field of the finances of business enterprises and in the second term studies the various forms of securities, both industrial and governmental, the machinery of investment, and the mathematics of security values. First and second terms (3).

26. STATISTICS. Statistical method and applied statistics. Practice in the handling and especially in the interpretation of statistics. First and second terms (3).

27. BANKING AND CURRENCY. A study of the banking system of the United States, comparing it with those of the important European states. The currency and currency problems of this country. Special emphasis is laid upon the Federal Reserve Act, foreign exchange, and factors affecting the money market. First and second term (3).

30. SUMMER READING IN ECONOMICS. Assignments for summer of 1925. Freshman: Marshall's *Readings in Industrial Society*. Sophomore: Gerstenberg's *Principles of Business*. Junior: Walker's *Management Engineering* (1).

30a. ECONOMICS FOR ENGINEERS. An intensive course for seniors in engineering curricula. The first term is devoted to an intensive study of the fundamental principles of economics, the second term to the fundamentals of accounting theory and practice. First and second terms (3).

31. ELEMENTS OF BUSINESS LAW. The principles of contract; formation of contracts; operation and discharge of contracts. First term (2).

32. ELEMENTS OF BUSINESS LAW. Principal and agent; master and servant; sale of goods; negotiable instruments; business associations; partnerships and corporations. Second term (2).

35. ECONOMIC GEOGRAPHY. A study of the geographic influences determining the economic life of various countries, of the sources of the chief economic materials, and of the physical assets of the leading industrial nations. First term (3).

36. ECONOMIC GEOGRAPHY. A continuation of 35. Second term (3).

38. INDUSTRIAL EVOLUTION. A general survey, for freshmen, of the growth of commercial and industrial organization, with an outline study of the present economic order. First term (3) and second term (4).

LATIN

PROFESSOR WRIGHT, MR. WARE

45. OVID AND VERGIL. Selections from the *Metamorphoses* and *Bucolics*. Lectures on the history and development of pastoral poetry. The influence of Latin poetry upon English literature emphasized. Insistence upon tasteful translation. Freshman. First term (3).

46. HORACE. Selected *Odes*. Lectures on the history and development of lyric poetry. Constant practice in reading the more important lyric metres. Memorizing of stanzas and passages from Horace. Freshman. Second term (3).

47. ANCIENT CIVILIZATION. A course aiming to impart a knowledge of ancient life and thought, with special emphasis on literature, art, science, and philosophy. Required reading in the best English translations of ancient authors. Assigned topics for investigation and report. Lectures on the art, architecture, and daily life of the ancients, illustrated by stereopticon. Freshman. First and second terms (3).

Courses 45 and 46 are required of freshmen in the B.A. curriculum who enter with four units of Latin; others in that curriculum take Course 47, except that those who prefer may, with the approval of the Professor of Latin, begin or continue Latin instead.

48. LIVY. Selections from Book I. CICERO. *De Amicitia. Letters*. CATÜLLUS. Select poems. A study of the literature and social life of republican Rome. Elective, sophomore year. *Prerequisites*: 45 and 46. First term (3).

49. PLAUTUS AND TERENCE. Careful study of a play of each with rapid reading of as much more as time permits. Private life of the Greeks and Romans. History of the drama at Rome. Elective, sophomore year. *Prerequisites*: 45 and 46. Second term (3).

50. SATIRE. Selected satires of Horace and Juvenal. Lectures on the history of Roman satire and its influence on modern literature. Study of social conditions under the Empire. Elective, junior and senior years. *Prerequisites*: 48 and 49. First term (3).

51. TACITUS. *Annals*. Portions of those books which deal with the life and principate of the Emperor Nero. Elective, junior and senior years. *Prerequisites*: 48 and 49. Second term (3).

52. VERGIL. *Aeneid*, Books VII-XII. Lectures on the history of the epic. Writing of brief dissertations on assigned topics. Elective, junior and senior years. *Prerequisites*: 48 and 49. First term (3).

53. LUCRETIVS. Careful study of one book entire of the *De Rerum Natura*, with reading of selections from the other books. Discussion of ancient materialistic theories. Some review of Roman philosophy and ethics. Elective, junior and senior years. *Prerequisites*: 48 and 49. Second term (3).

54. HIGH SCHOOL LATIN. For prospective teachers of Latin in secondary schools. Prose composition and a review of secondary school Latin, the members of the class conducting the class in turn under the supervision of the Professor of Latin to the end that they may enter upon the teaching of Latin in preparatory or high school with freshened knowledge of the subject and with some experience in presenting it. This course is ordinarily taken in connection with courses in education. Junior or senior year. *Prerequisites*: 48 and 49. First and second terms (2).

54a. CICERO. Orationes and Letters. Prose composition and syntax, with special emphasis on clause construction. A course designed for students who enter with two years of high school Latin and who elect to continue their Latin rather than take Course 47. First term (3).

54b. VERGIL. *Aeneid*, Books I-VI. Prose composition continued. Practice in reading aloud and scansion. Training in sight translation. Some study of the mythology and religion of Greece and Rome. Second term (3).

54c. BEGINNING LATIN AND CAESAR. Special emphasis on English derivatives and the principles of grammar. First and second terms (3).

GREEK

PROFESSOR GOODWIN

55. **LYSIAS.** Selected *Orations*; or **XENOPHON,** *Memorabilia*. Review of the grammar. Composition and other exercises. Careful study of Attic prose syntax; special attention given to the formation of correct methods of study and translation, to grammatical analysis, and to the reading aloud of Greek. Available time employed in sight-reading. **HERODOTUS.** One book begun. *Prerequisites:* 64 and 65, or Entrance Greek. First term (3).

56. **HERODOTUS** (continued). Study of the forms and syntax of the Ionic dialect. **PLATO.** *Euthyphro*, *Apology*, or other shorter dialogues. Grammar and composition as in the first term. *Prerequisite:* 55. Second term (3).

57. **THUCYDIDES.** One or more books. Composition. *Prerequisites:* 55 and 56. First term (3).

58. **TRAGEDY.** **EURIPIDES.** *Medea*, *Bacchae*, or another play. **SOPHOCLES.** *Oedipus Tyrannus*, *Antigone*, or another. Literary study of the drama. Poetical language, style, and conception. Metrical reading. Composition. *Prerequisites:* 55 and 56. Second term (3).

59. **DRAMATIC POETRY** (continued). **AESCHYLUS.** *Agamemnon*, or *Prometheus Bound*. **ARISTOPHANES.** *Clouds*, *Frogs*, or *Birds*. Aristophanes as humorist and as moralist, with consideration of the tendencies which he satirized. Metres. Elementary text-criticism. *Prerequisites:* 55, 56, 58. First term (3).

60. **GREEK ORATORY.** Jebb's *Selections from the Attic Orators*. **DEMOSTHENES.** Selected orations. Rapid reading, the student being supposed to have reasonable facility in understanding the Greek directly without rendering into English. Attention directed largely to those points which illustrate the development of Greek prose style. *Prerequisites:* 55 and 56. Second term (3).

61. **HOMER.** Rapid reading of considerable portions of the *Iliad* or *Odyssey*. Homeric language, syntax, and metre reviewed, with some reference to the needs of intending teachers, but chiefly as a foundation for the study outlined in Course 62. *Prerequisites:* 55 and 56. First term (3).

62. LYRIC POETRY. Fragments of the Elegiac, Iambic, and Melic Poets. Selections from PINDAR or THEOCRITUS. *Prerequisites*: 55, 56, and 61. Second term (3).

63. HELLENISTIC GREEK. *New Testament*. Selections from LUCIAN. To be substituted on occasion for 62. *Prerequisites*: 55, 56, and the approval of the Professor. Second term (3).

Courses 59 and 61, 60 and 62 (or 63) are offered in alternate years, and are open to both juniors and seniors.

Candidates for honors in Greek will be assigned special readings on request.

64. ELEMENTARY GREEK. A course offered (ordinarily only in alternate years) to freshmen and sophomores who have entered without Greek, but who desire to take up the study in college. They perform in two years approximately the amount of work required for admission from those who present Greek, and are prepared to proceed in the third year with Course 55. The introductory book and a small portion of the *Anabasis* are studied in the first two terms. Given in 1924-1925; to be omitted in 1925-1926 (unless at least six applications are received). *Prerequisite*: None, but some knowledge of Latin is highly desirable. First and second terms (3).

65. SECOND-YEAR GREEK. *Anabasis* continued; *Iliad* (if time permits); grammar and simple composition. Offered only when Course 64 has been given in the preceding year. *Prerequisite*: 64, or one year of Entrance Greek. First and second terms (3).

GERMAN

PROFESSOR PALMER,

ASSISTANT PROFESSORS MORE* AND DOWNS, MR. ROEST

70. ELEMENTARY GERMAN. First term (3).

71. ELEMENTARY GERMAN, continued. *Prerequisite*: 70, or the equivalent. Second term (3).

73. GERMAN OF CHEMISTRY. Rapid reading of selected texts on chemistry. For sophomore chemical engineers who have passed Course 71. *Prerequisites*: 71, or the equivalent. First term (2).

* On leave of absence, 1924-1925.

75. MODERN GERMAN PROSE. Thorough review of German grammar. Prose composition. *Prerequisite:* Entrance German or 71. First and second terms (3).

77. GERMAN PROSE AND POETRY. Heine, Keller, C. F. Meyer, Freytag, Storm, Heyse. Composition. *Prerequisite:* Entrance German or 71. First and second terms (3).

78. MODERN GERMAN PROSE (continued). Rapid reading of representative texts. *Prerequisite:* 75 or 77. First term (3).

79. GOETHE'S FAUST. Study of Part I. Lectures on the origin and development of the Faust story. *Prerequisite:* 77 or the equivalent. Second term (3).

80. NINETEENTH CENTURY GERMAN DRAMA. Lectures, reading, reports on assigned work. *Prerequisite:* 77 or the equivalent. First and second terms (3).

81. GOETHE'S DRAMAS: *Goetz, Egmont, Iphigenie, Tasso, Faust*, Part II. *Prerequisite:* 77 or the equivalent. First and second terms (3).

82. THE GERMAN SHORT STORY. Origin and development. Rapid reading of illustrative stories, with particular attention to Gottfried Keller, Theodor Storm, C. F. Meyer, and Paul Heyse. Lectures and reports. *Prerequisite:* 77 or the equivalent. First and second terms (3).

83. METHODS IN GERMAN. A course for prospective teachers in advanced German grammar. German composition, methods of teaching, and discussion of text-books. *Prerequisites:* 78 and 79, or the equivalent. First or second term (2).

ROMANCE LANGUAGES

PROFESSOR FOX, ASSISTANT PROFESSOR TOOHY,
MESSRS. EWING, PERKINS, CONVERS, AND ODA

FRENCH

90. ELEMENTARY FRENCH. Elementary French grammar. Easy readings in French prose. Practice in speaking and writing simple French, based upon the texts used. A course intended primarily for junior students in the College of Arts and Science; introductory to Course 97. First and second terms (3).

91. **ELEMENTARY FRENCH.** An intensive course in elementary French for senior Metallurgists. Emphasis upon the development of a reading knowledge of French. Grammatical drill limited to the essentials. First term (3).

92. **ELEMENTARY FRENCH.** A sophomore elective for students in the College of Arts and Science who wish three years of French and can therefore give time to a more detailed drill in grammar and composition as well as practice in writing and speaking; introductory to Course 97. First and second terms (3).

93. **FRENCH ORAL COMPOSITION.** A course for students who wish a greater opportunity to practice in the oral and written use of modern French prose. Especially recommended for those who expect to teach French. First and second terms (2).

94. **FRENCH (continued).** A course for freshmen who enter with French. Thorough review of the grammar with composition work, both oral and written, based upon the grammar and upon the texts read. Texts selected from writers of modern French prose. *Prerequisite:* Entrance French. First and second terms (3).

96. **FRENCH: TEXT AND METHODS.** First or second term, or both (1 or 2).

97. **FRENCH: RAPID READING.** Sight Translation. Dictation. Oral drill in the use of a practical vocabulary. *Prerequisite:* 90 or 92. First and second terms (3).

98. **FRENCH PROSE AND POETRY.** Balzac, Flaubert, Maupassant, Daudet, Zola. *Prerequisite:* Entrance French. First term (3).

99. **FRENCH PROSE AND POETRY (continued).** Molière, Corneille, Racine. Society in the seventeenth century. *Prerequisite:* 98. Second term (3).

100. **FRENCH LITERATURE IN THE SEVENTEENTH CENTURY.** *Prerequisites:* 98 and 99. First term (3).

101. **FRENCH LITERATURE IN THE EIGHTEENTH CENTURY.** *Prerequisites:* 98 and 99. Second term (3).

102. **FRENCH SOCIAL FORCES.** Rapid reading of modern French authors, introducing certain of the social and political problems of France and her people today. Reading of texts by such authors as Thiers, Lamartine, and Michelet, to furnish the

necessary background. *Prerequisites*: 100 and 101. First and second terms (3).

103. FRENCH LITERARY HISTORY. General review of French literature. Reading, lectures, and explanation of texts. *Prerequisites*: 100 and 101. First and second terms (3).

104. FRENCH LITERATURE IN THE NINETEENTH CENTURY. *Prerequisites*: 100 and 101. First and second terms (3).

105. FRENCH LITERATURE IN THE SIXTEENTH CENTURY AND EARLIER. May be substituted in place of 102, 103, or 104. *Prerequisites*: 100 and 101. First and second terms (3).

SPANISH

109. ELEMENTARY SPANISH. A beginners' course intended primarily for students in Arts and Science. First term (3).

110. ELEMENTARY SPANISH. Grammar, reading, and composition. A course open to all students of the University. First and second terms (3).

111. SPANISH: LATIN-AMERICAN HISTORY. Reading and discussion in Spanish of texts dealing with the history of Latin-American countries. Prose composition. *Prerequisite*: Entrance Spanish. First and second terms (3).

112. SPANISH CONTINUED. A continuation of Course 110. *Prerequisite*: 110. First and second terms (3).

113. SPANISH CONTINUED (FOR BUSINESS STUDENTS). A course similar to Course 111 but intended primarily for students in Business Administration. *Prerequisite*: Entrance Spanish. First and second terms (3).

114. SPANISH NOVELS AND PLAYS. A second-year course, intended more especially for students in the B.A. curriculum; may be substituted by them for Course 112. *Prerequisite*: 109 or 110. First and second terms (3).

114a. SPANISH. An advanced course in Spanish literature, intended primarily for students in the B.A. course. *Prerequisite*: 114.

115. SPANISH. Reading and discussion in Spanish of texts dealing with the commercial and industrial relations of Latin-America. Spanish commercial correspondence. *Prerequisite*: 113. First and second terms (3).

PORTUGUESE

116. ELEMENTARY PORTUGUESE. Grammar and composition. Rapid reading of modern literature, with particular reference to the history and social and economic conditions in Brazil and Portugal. First and second terms (3).

117. PORTUGUESE CONTINUED. *Prerequisite*: 116. First and second terms (3).

ITALIAN

118. ELEMENTARY ITALIAN. Grammar and composition. Rapid reading of easy modern prose. First and second terms (3).

119. ITALIAN CONTINUED. Masterpieces of classic periods; outside reading. *Prerequisite*: 118. First and second terms (3).

ENGLISH

PROFESSORS THAYER AND LUCH;
ASSISTANT PROFESSOR MESCHTER; MESSRS. LAMBERT, DRAWBAUGH,
AND RECTOR

120. RHETORIC. A composition course based on Hill's *Principles of Rhetoric*, Genung's *Working Principles of Rhetoric*, Barrett Wendell's *English Composition* and French's *Writing*, with the latter as text-book; the other books will be freely used for consultation. Recitations and themes on assigned subjects. For all Freshmen. First term (3).

121. AMERICAN LITERATURE. Lectures and recitations on the basis of Pattee's *Century Readings in American Literature* and other books as assigned. For all freshmen. Second term (3).

Fulton's *College Life* will be read in the first term; Harcourt, Brace and Company, *Adventures in Essay Reading*, in the second term.

122. DEVELOPMENT OF ENGLISH. Lectures and class-room work, using as text-books Emerson's *Brief History of the English Language*, Trench's *English Past and Present* (revised), Bradley's *The Making of English*, and kindred works. Skeat's *Principles of English Etymology* will be consulted. Junior elective, leading to course No. 128. Second term (3).

123. ENGLISH LITERATURE. An outline course developed in recitations and lectures with parallel readings, as assigned. Text-book: Snyder and Martin, *Book of English Literature*. Parallel reading, F. M. Smith's *Essays and Studies*. For sophomores. First term (3).

124. LITERARY CRITICISM. The subject varies annually between topics taken from Elizabethan and from XIX. Century Literature. In 1925-26 The Elizabethan Stage and the University Wits will be the subject of intensive study. For sophomores. Second term (3).

125. ORATORY. A course based on Collins' *Platform Speaking*; required of freshmen in Arts and Science and Business Administration, elective with sophomore students in the same curricula; embracing recitations and the composition and delivery of orations and speeches on topics of current interest. Second term (1).

126. ANGLO-SAXON. Sweet's *Anglo-Saxon Primer and Reader*, with lectures on early English literature and readings from the works of Brooke and Earle. Junior electives. First term (3).

127. TECHNICAL WRITING. A course of practical exercises in composition on themes taken from the literature of the sciences of observation. Text-book: Harbarger's *English for Engineers*, or equivalent. Junior elective. Second term (2) or (3) as assigned by the curriculum head. Required reading: Aydelotte's *English and Engineering*.

128. ENGLISH PHILOLOGY. The principles of the philology of the English language as developed in the works of Earle, Trench, Morris, and Skeat. By a process of elimination the elements derived from Romance and other sources are excluded, and the residum examined, in vocabulary and grammar, as a Teutonic tongue; with special reference to the intensive development of the language before the Age of Chaucer. Junior elective. *Prerequisite*: 122. Second term (3).

129. NINETEENTH CENTURY LITERATURE. In 1925-26 the Lake School: Wordsworth, Coleridge and Southey, with DeQuincey and Lamb—a group considered together for their affinities in subjects, thought, and style. In alternate years Tennyson, Browning, and the Pre-Raphaelites will be studied. Junior elective, seniors admitted. First term (3).

130. MIDDLE ENGLISH. A critical study of the English of Chaucer, Langland, and Gower; followed by the literary study of selected specimens of their works. Text-books: *The Student's Chaucer*, Skeat's edition of *The Vision of Piers the Plowman*, and Gower's *Confessio Amantis* assigned. Senior elective. First term (3).

131. POETICS. A course based on Gummere's *Handbook of Poetics*, Alden's *English Verse*, Saintsbury's *Loci Critici*, with the use of Palgrave's *Golden Treasury* and *The Oxford Book of English Verse*, and practical exercises in verse-composition. Senior elective. Second term (3).

133. CONTEMPORARY DRAMA. Lectures, with the criticism of typical modern plays. Lewis' *Contemporary One-Act Plays*, Baker's *Modern American Plays*, Galsworthy's *Typical Modern Plays*, and Chandler's *Aspects of Modern Drama* will be read, and other books introduced for illustration and criticism. Open to juniors and seniors. Second term (3).

134. TWENTIETH CENTURY LITERATURE, especially the Novel, and Lyric Poetry in its chief subdivisions, since 1895. As guides to academic reading these books will be used: Cunliffe's *English Literature of the Last Half-Century*, Follett's *Some Modern Novelists*; Sherman, *On Contemporary Literature*; Phelps' *Essays on Modern Novelists*, with as much actual novel reading as time will permit. Senior elective. Second term (3).

N.B.—Books for all elective courses should be secured when the course is chosen, to avoid troublesome delays.

MATHEMATICS AND ASTRONOMY

PROFESSORS THORNBURG, LAMBERT,* AND OGBURN,

ASSOCIATE PROFESSORS STOCKER AND REYNOLDS,

ASSISTANT PROFESSOR KNEBELMAN, MESSRS. SOLT, LYLE,

BALOF, KICHLINE

140. SOLID GEOMETRY, beginning with Book VI and completing the subject. Second term (3).

141. PLANE TRIGONOMETRY. Including the theory and use of logarithms. First term (3).

142. SPHERICAL TRIGONOMETRY. Including the use of logarithmic tables. Second term (1).

* Deceased, February 15, 1925.

143. ADVANCED ALGEBRA, beginning with the Theory of Quadratic Equations. Review of Plane Trigonometry and Elementary Algebra. First term (4).

144. HIGHER ALGEBRA. Theory of Equations. Determinants, Sturm's Functions, Cardin's Solution of the Cubic, Euler's Solution of the Biquadratic. *Prerequisite*: 143. First term (1).

145. PLANE ANALYTIC GEOMETRY. Graphic representation of loci on cross-section paper. Plane analytic geometry. Second term (3).

146. DIFFERENTIAL CALCULUS AND SOLID ANALYTICAL GEOMETRY. Embracing applications to analytic geometry and practical problems. *Prerequisites*: 143, 145.

147. INTEGRAL CALCULUS. General integration methods with applications to theory of Center of Gravity and Moment of Inertia, together with a short chapter on Elementary Ordinary Differential Equations. *Prerequisite*: 146. Second term (4).

148. DIFFERENTIAL EQUATIONS. *Prerequisite*: 147. First term (1).

149. ANALYTIC MECHANICS. Differential equations of motion, treatment of forces in space, free and constrained motion of a particle and of masses, with applications to practical problems. *Prerequisite*: 147. First term (2).

150. DESCRIPTIVE ASTRONOMY. A study of the fundamental facts and principles of the subject with solution of problems; observatory visits. First or second term (3).

151. PRACTICAL ASTRONOMY. Study of instruments used, methods of taking and reducing observations to determine time, latitude, longitude, and azimuth; observatory work in which each student makes his own observations and computations in illustration of the problems studied. As this study is primarily for civil engineers, the sextant and engineer's transit are the chief instruments employed in the observational work. *Prerequisites*: 141, 142, 147, 150. First term (3).

152. ANALYTIC MECHANICS. *Prerequisites*: 147, 148, 149. Second term (3).

153. NAVIGATION. Study of principles and instruments used in navigation, with practical navigation problems by modern methods. *Prerequisite*: 150. Second term (2).

154. BUSINESS MATHEMATICS. Interest and Discount, Annuities, Sinking Funds, Bonds, Depreciation, Insurance. Second term (3).

155. DIFFERENTIAL EQUATIONS. Hyperbolic functions, Elementary functions of Complex Variables, Solution of Total Differential Equations, Symbolic Operators, Solution in Series, Fourier's Series, Elementary Partial Differential Equations. *Prerequisites*: 146, 147. Two terms (3).

156. UNIFIED MATHEMATICS. Selected topics in Algebra, Trigonometry, and Analytic Geometry.

CIVIL ENGINEERING

PROFESSORS FOGG AND WILSON,

ASSOCIATE PROFESSORS BECKER AND FULLER,

ASSISTANT PROFESSORS PAYROW, LEWIS, AND UHLER, MR. NOYES

160. ENGINEERING DRAWING. The use of drawing instruments. Lettering and tracing. Mechanical drawing of objects. Simple projections. Isometric drawing. First term (3).

161. ENGINEERING DRAWING. The descriptive geometry of projections, intersections, and developments. Plans, elevations, and sections of simple structural details. *Prerequisite*: 160. Second term (2).

162. ENGINEERING DRAWING. The use of drawing instruments; lettering and simple projections. Second term (1).

163. ENGINEERING DRAWING. The descriptive geometry of projections, intersections, and developments. Isometric drawings, plans, elevations, and sections of simple structural details. *Prerequisite*: 162. First term (3).

164. ENGINEERING AND TOPOGRAPHIC DRAWING. Problems in stone cutting, including plans for pipes, culverts, and arches. Isometric drawings and linear perspective. Topographic maps. *Prerequisite*: 163. Second term (2).

165. LAND AND TOPOGRAPHIC SURVEYING. The theory and practice of land surveying, including computation of areas, dividing land, determining heights and distances. Map drawing and topographic signs. Field work with level and transit. Map drawing from students' field notes. Theory and use of stadia. Detailed field work in rough country; pen topography and contour maps. Students in Civil Engineering, in Mining Engi-

neering, and in Marine Engineering are required to take this work. The fee for other persons is \$10 per credit hour. (After September 1, 1925, a charge of \$10 per credit hour will be made for all summer courses whether optional or required.) *Prerequisite*: plane trigonometry and engineering drawing. Summer term: a recitation and seven hours of field work each week-day for four weeks, beginning June 8, 1925 (5).

166. RAILROAD SURVEYING. Reconnaissance, preliminary and location methods, with the theory of curves. *Prerequisite*: 165. Summer term: a recitation and seven hours of field work each week-day for two weeks, immediately following Course 165. Students in Civil Engineering, in Mining Engineering, and in Marine Engineering are required to take this course. The fee for other persons is \$10 per credit hour. (After September 1, 1925, a charge of \$10 per credit hour will be made for all summer courses whether optional or required.) (2½).

167. MECHANICS OF MATERIALS. The elasticity and strength of timber, brick, stone, and metals. Theory of beams, columns, and shafts, with the solution of many practical problems. *Prerequisites*: 320, 321, 324, 147. First term (4).

167a. MECHANICS OF MATERIALS. An abridgement of Course 167. *Prerequisites*: 320, 321, 324, 147. First term (3).

168. MATERIALS TESTING LABORATORY. Fourteen experiments made by each student on wood, iron, and steel to determine the action of materials under stress and to study the physical properties of materials of construction. The Fritz Engineering Laboratory, where this work is done, is equipped with 20,000, 50,000, 100,000, 300,000, and 800,000-pound machines for tension, compression, and flexure, a 50,000-inch-pound machine for torsion, and other apparatus for special work. Concurrent with 167 or 167a. Fee, \$5. First term (1).

169. RAILROADS. Theory of curves and turnouts. Preparation of profiles and maps. The computation of earth work and estimates of cost. The construction of road-bed, including ballast, cross ties, rails, switches, culverts, and other details. *Prerequisite*: 166. First term (4).

170. HYDRAULICS. Hydrostatics and theoretical hydraulics. The flow of water through orifices, weirs, tubes, pipes, and channels. Naval hydromechanics. Hydraulic motors. The

solution of many practical problems. *Prerequisites*: 320, 321, 324, 147. Second term (3).

170a. HYDRAULICS. An abridgment of Course 170. *Prerequisites*: 320, 321, 324, 147. Second term (2).

171. HYDRAULIC LABORATORY. Fourteen experiments made by each student in the hydraulic section of the Fritz Engineering Laboratory, which is equipped with pumps, weirs, turbines, water-wheels, meters, and other apparatus for special work. Concurrent with 170 or 170a. Fee, \$5. Second term (1).

172. ROOFS AND BRIDGES. Analytical and graphical determination of stresses in roof and bridge trusses under dead, live, and wind loads. Locomotive wheel loads on plate girders and bridge trusses. *Prerequisite*: 167 or 167a. Second term (4).

173. HIGHWAY ENGINEERING. The location, construction, and maintenance of roads and pavements. Highway design. *Prerequisites*: 165, 166. Second term (3).

174. GRAPHIC STATICS AND SURVEYING. A special course given to junior Mechanical Engineering students. The first part of the term is devoted to the graphical determination of stresses in roof trusses by the force polygon. The last part of the term is devoted to the elements of plane surveying, including field work. *Prerequisites*: 320, 321. Second term (3).

175. STRUCTURAL STEEL DESIGN. Lectures and recitations. Theory of structural steel design and complete calculations for a through plate girder railroad bridge and for a highway truss bridge. Design of mill buildings and miscellaneous structures. *Prerequisite*: 172. First term (3).

176. STRUCTURAL STEEL DESIGN. A special course arranged for seniors in Marine Engineering. A study of the stresses acting on steel structures, with special attention to the local stresses in a ship's structure; the design of cranes, warehouses, and other steel structures; solution of problems by graphical methods. *Prerequisite*: 167 or 167a. First term (3).

177. BRIDGE DESIGN DRAWING. Design and working drawings for structures, including a plate girder railway bridge, a highway truss bridge and a mill building. Concurrent with 172. First term (3).

178. GRAPHIC STATICS. Analysis of the stresses in roof trusses by the force polygon. Applications of the equilibrium polygon to the discussion of beams and girders. *Prerequisites*: 320, 321. First term (2).

179. HYDRAULIC AND WATER POWER ENGINEERING. Three recitations and one drawing-room exercise a week devoted to systems of water supply, including purification of systems, reservoirs, pipe lines, pumping plants. The design of a water supply distribution system. The measurement of flow in open channels by means of tubes and meters. Water power. Irrigation. *Prerequisites*: 170 or 170a. First term (4).

180. GEODESY. Recitations, calculations, field work. Precise leveling. Adjustment of instruments and investigation of their systematic errors. Elements of least squares and their application to the adjustment of triangulations. Field work in triangulation, in determination of azimuth, and with the plane table. *Prerequisites*: 165, 166. First term (3).

181. RAILROADS AND TERMINALS. Maintenance of way, and the elements of railroad operation. Lectures on the economics of railroad location; the arrangement of yards, stations, and terminals; train resistance; the application of electricity to the operation of railroads. *Prerequisite*: 169. First term (3).

182. HIGHER STRUCTURES. Theory of continuous, draw, cantilever, and suspension bridges; also metallic arches. The theory and design of masonry walls, dams, and arches. Theory of deflections and applications to statically indeterminate structures. *Prerequisite*: 172. Second term (3).

183. REINFORCED CONCRETE DESIGN AND FOUNDATIONS. Theory of reinforced concrete; design of reinforced concrete buildings, arches, and miscellaneous structures. Foundations. *Prerequisites*: 167 or 167a; highly desirable, 172. Second term (3).

184. CEMENT AND CONCRETE LABORATORY. The manufacture, properties, and testing of cement, mortar, and concrete. All the standard tests are made by each student on cement and on reinforced concrete beams and columns in the Fritz Engineering Laboratory. Concurrent with 183. Fee, \$3. Second term (1).

185. **CONTRACTS AND SPECIFICATIONS.** Lectures on the essentials of contracts and specifications for engineering structures. *Prerequisite:* Junior standing. Second term (2).

186. **SANITARY ENGINEERING.** Systems of sewerage and methods of sewage treatment and disposal. The design of a sewerage system. House drainage. *Prerequisite:* 179. Second term (3).

187. **SUMMER WORK IN CIVIL ENGINEERING.** During the summer following the junior year, students are required to spend at least eight weeks in shop work or on engineering construction.

MECHANICAL ENGINEERING

PROFESSORS LARKIN, KLEIN, AND BUTTERFIELD,

ASSOCIATE PROFESSOR MEASE,

ASSISTANT PROFESSORS QUAST AND NORDENHOLT,

MESSRS. LEACH, KOLB, AND KISTLER

200. **DRAWING AND ELEMENTS OF MACHINE DESIGN.** Orthographic, isometric, and oblique projections, intersections, and developments. Sketches and working drawings of machine pieces, tracings, details of screw-fastenings, keys, and other fastenings. *Prerequisite:* 321. First term (3).

201. **HEAT ENGINES.** Classification and types of engines, governors, valve gears, valve diagrams, indicator diagrams, efficiency. Fuels, combustion, boilers, superheaters, feed water heaters, condensers. *Prerequisite:* 321. First term (3).

202. **MECHANISM.** A study of the mechanics of machine parts. Development of links, cams, gears, transmission machinery, and the determination of dimensions from the standpoint of strength and durability taken up in detail in the class room. Practical problems developed in the drawing-room. *Prerequisite:* 320. First term (3).

203. **ELEMENTS OF MACHING DESIGN.** Calculations of the dimensions of elementary machine parts, such as spur, bevel, and worm-gears, pulleys, shafting, couplings, bearings, connecting rods, etc., from the forces acting upon or transmitted by such machine parts. Working drawings of these pieces. *Prerequisite:* 320. Second term (3).

204. HEAT ENGINES. Continuation of 201. Second term (3).

205. MECHANISM. Continuation of 202. Second term (3).

206. GRAPHIC STATICS OF MECHANISMS. Graphical determination of the forces acting on all the various pieces constituting a machine, covering a great variety of machines; drawings of these machines given to the students. Consideration of frictional and inertia resistances and determination of the efficiencies of mechanisms. *Prerequisite*: 321. Fee, \$2.50. First and second terms (2).

207. HEAT ENGINES. Theory of steam turbines, internal combustion engines, gas producers, and refrigeration. Class and drawing-room work. *Prerequisite*: 204. First term (4).

208. ENGINEERING LABORATORY. Use and calibration of apparatus for measuring weight, volume, pressure, temperature, speed, etc., for engineering purposes. *Prerequisite*: 201. Fee, \$3.50. First term (1).

209. HEAT ENGINES. Theory of steam turbines, internal combustion engines, gas producers, and refrigeration. Continuation of 207. Second term (4).

210. ENGINEERING LABORATORY. Work of 208 continued. Indicator practice on engines in the laboratory and in factories and power plants in the neighborhood; complete working up of indicator diagrams from simple and compound engines, air compressors, etc. *Prerequisite*: 201. Fee, \$3.50. Second term (1).

211. ADVANCED MACHINE DESIGN. The design of machines in general, with special attention to the calculation and designing of the various parts for strength, stiffness, and other requirements. Problems covering such machinery as cranes, hoists, pumps, machine tools, hydraulic machinery, etc. *Prerequisites*: 203; 167a. First term (4).

212. MECHANICAL ENGINEERING. Advanced work in thermodynamics, internal combustion engines, and steam turbines, with typical problems. *Prerequisites*: 147; 209. First term (4).

213. ENGINEERING LABORATORY. Work of 208 and 210 continued. Tests of boilers, of power plants and pumping stations in the neighborhood. *Prerequisite*: 210. Fee, \$3.50. First term (1).

214. THESIS. Each candidate for the degree of Mechanical Engineer is required to present a satisfactory thesis on some topic, showing a grasp of the underlying principles of the subject investigated. *Prerequisite*: 209. Second term (3).

215. ADVANCED MACHINE DESIGN. Continuation of 211, being more specialized. *Prerequisites*: 203; 167a. Second term (4).

216. MECHANICAL ENGINEERING. Continuation of 212. Advanced work in pumping machinery, air machinery, and refrigeration, with typical problems. *Prerequisites*: 147; 209. Second term (4).

217. ENGINEERING LABORATORY. Work of 213 carried forward, along the same lines. Analysis of flue gases; complete tests of power plants of the vicinity. *Prerequisite*: 210. Fee, \$3.50. Second term (1).

218. ENGINEERING LABORATORY. A course selected from 210, 213, and 217, dealing more particularly with heat transfer apparatus, for students in Chemical Engineering. *Prerequisite*: 225. Fee, \$3.50. First term (1).

219. ENGINEERING LABORATORY. Work of 218 completed, along the same lines. *Prerequisite*: 225. Fee, \$3.50. Second term (1).

220. ENGINEERING LABORATORY. A shorter course, selected and condensed from 208, 210, 213, and 217, especially in steam engineering, for students in curricula other than Mechanical Engineering. *Prerequisite*: 201 or the equivalent. Fee, \$3.50. First term (1).

221. HEAT ENGINES. Short course for students in curricula other than Mechanical Engineering, covering steam engines, steam turbines, internal combustion engines, and boiler plants. *Prerequisite*: 321. First term (3).

222. HEAT ENGINES. Work of 221 completed. *Prerequisite*: 321. Second term (3).

223. HEAT ENGINES. Classification and types of engines and power plant auxiliaries and apparatus, fuels, combustion, steam turbines, internal combustion engines; a composite course for students in the curriculum in Chemical Engineering. *Prerequisite*: 321. First term (3).

224. HEAT ENGINES. Continuation of 223. *Prerequisite*: 321. Second term (3).

225. ENGINEERING LABORATORY. A summer course of four weeks for students in Chemical Engineering, comprising a series of experiments and tests of heat transfer, apparatus, calorimetry, heat engines, and auxiliaries. *Prerequisites*: 223, 224. Fee, \$3.50. (After September 1, 1925, a charge of \$10 per credit hour will be made for all summer courses whether optional or required.) Summer term (3).

226. ENGINEERING LABORATORY. Work of 220 completed, along the same lines. *Prerequisite*: 204 or the equivalent. Fee, \$3.50. Second term (1).

227a. WORK IN INDUSTRIAL PLANT. Following the freshman year students are required to spend a minimum of eight weeks in an industrial plant of approved character. A report is required. Summer term (3).

227b. WORK IN INDUSTRIAL PLANT. Following the sophomore year students are required to spend a minimum of eight weeks in industrial plants of approved character. A report is required. Summer term (3).

228. STUDENT APPRENTICESHIP, OR ENGINEERING CONSTRUCTION, OR SHOP WORK. Following the junior year students are required to do a minimum of eight weeks of practical work, preferably as student apprentices, in the work they plan to follow after graduation. A report is required. Summer term (3).

METALLURGICAL ENGINEERING

PROFESSOR STOUGHTON,

ASSOCIATE PROFESSOR ROUSH,

ASSISTANT PROFESSOR BUTTS, MR. DUCK

243. GENERAL METALLURGY. A course of lectures discussing the general principles of metallurgy as applied to the metallurgy of the various metals. Ores, fuels, combustion, pyrometry, refractories, furnaces, metallurgical processes and products, metals and alloys, slags and fluxes, blast and gases, smoke and fume. Hofman's *General Metallurgy*; Fulton's *Principles of Metallurgy*. *Prerequisites*: 398, 399. First term (2).

244. METALLURGICAL PROBLEMS. A course of problems embodying the use of the physical, chemical, and mechanical principles as the basis of practical metallurgy. Data are taken,

so far as possible, from actual practice, so that the results have an important bearing in the understanding of metallurgical processes. Reference: Richards' *Metallurgical Calculations, Part I. Prerequisite*: 397. Must accompany Course 243. First term (1).

245. METALLURGY OF IRON AND STEEL. Chemical and physical properties of iron. Iron ores. Preparation of ores. The blast furnace. The mixer. Remelting. Refining. Puddling. The Bessemer process. The open-hearth process. Duplex process. Cementation. Manufacture of crucible steel. Electric steel. Alloy steels. Casting, forging, and heat treatment. Text-book: Stoughton's *Metallurgy of Iron and Steel. Prerequisite*: 243. Second term (2).

246. METALLURGICAL PROBLEMS. A course of problems involving the fundamental principles of the various processes in the metallurgy of iron and steel, to give the student an understanding of the quantitative relationships in the processes. Richards' *Metallurgical Calculations, Part II. Prerequisites*: 243, 244. Must accompany Course 245. Second term (1).

247a. METALLURGY: SHORT COURSE. An abridgment of courses 243 and 245 for students in Civil, Mechanical, Electrical, and Mining Engineering. Text-book: Stoughton's *Metallurgy of Iron and Steel. Prerequisite*: 390. First and second terms (2).

247b. METALLURGICAL PROBLEMS. An abridgment of courses 244 and 246 for students in Civil, Mechanical, Electrical, and Mining Engineering. Reference book: Richards' *Metallurgical Calculations, Parts I and II. Prerequisites*: 390, 397, 321. First and second terms (1).

248. METALLURGY OF COPPER, LEAD, SILVER, AND GOLD. COPPER: Chemical and physical properties. Ores. Smelting sulphide ores. The Bessemer process. Treatment of oxide ores. Wet process. Electrolytic processes. LEAD: Chemical and physical properties. Ores. Smelting processes. Condensation of lead fume. Refining and desilverization of base bullion. SILVER: Chemical and physical properties. Ores. Smelting with lead. Amalgamation. Leaching processes. GOLD: Chemical and physical properties. Ores. Gold washing. Gold milling. Chlorination. The cyanide process. Parting gold and silver. Reference books: Gowland's *Metallurgy of the Non-Ferrous*

Metals, Austin's *Metallurgy of the Common Metals*, Schnabel's *Handbook of Metallurgy*, Hofman's *Metallurgy of Copper*, Hofman's *Lead*, Collins' *Silver*, Rose's *Gold*. *Prerequisites*: 243 and 247. First term (2).

249. METALLURGICAL PROBLEMS. A course of problems concerned with the principles utilized in the metallurgy of copper, lead, silver, and gold. Reference: Richards' *Metallurgical Calculations*, Part III. *Prerequisite*: 244. Must accompany Course 248. First term (1).

250. METALLURGY OF ZINC, MERCURY, TIN, ALUMINUM, NICKEL, ETC. ZINC: Chemical and physical properties. Ores. Reduction by furnace and electrolytic processes; electrothermic processes. Manufacture of zinc oxide. MERCURY: Chemical and physical properties. Ores. Processes of extraction. ALUMINUM: Chemical and physical properties. Ores. Extraction by electrolysis. TIN, NICKEL, PLATINUM, ANTIMONY, etc.: Chemical and physical properties. Ores. Processes of extraction. Reference books: Gowland's *Metallurgy of Non-Ferrous Metals*, Austin's *Metallurgy of the Common Metals*, Schnabel's *Handbook of Metallurgy*, Ingall's *Zinc*, Richards' *Aluminum*, Louis' *Metallurgy of Tin*, Wang's *Antimony*. *Prerequisite*: 243. Second term (2).

251. METALLURGICAL PROBLEMS. A course of problems concerned with the principles utilized in the metallurgy of zinc, mercury, aluminum, etc. Reference: Richards' *Metallurgical Calculations*, Part III. *Prerequisite*: 244. Must accompany Course 250. Second term (1).

252. ELECTROCHEMISTRY. Lectures discussing the historical development of the subject, particularly the phenomena of electrolysis and the various theories proposed to account for them; current phenomena; voltage phenomena; energy relations; electrode reactions; the electrolytic cell; electrothermics. Reference books: Le Blanc's *Text-book of Electrochemistry*; Allmand's *Applied Electrochemistry*. *Prerequisites*: 398, 399, 419, 421. First term (1).

253. ELECTROMETALLURGY. Lectures discussing the practical application of electricity to metallurgical processes; electrolytic and electric furnace plants and practice. Reference books: McMillan's *Electrometallurgy*; Allmand's *Applied Electrochemistry*. *Prerequisites*: 243, 252. Second term (1).

254. **ELECTROCHEMISTRY AND ELECTROMETALLURGY.** A combination of Courses 252 and 253, for students in Electrical and Mining Engineering. *Prerequisite:* 247. First term (2).

255. **ELECTROCHEMICAL LABORATORY.** Quantitative relations in the deposition of metals by electrolysis. Experimental study of the conditions controlling the nature of electrolytic deposits. Electrolysis of fused salts. Cathodic and anodic reactions. Must accompany Course 252. Fee, \$5. First term (1).

256. **METALLURGICAL LABORATORY.** Principles of process metallurgy; such as alloying, galvanizing, measurement of air volume and moisture content, desilverization of lead, cementation of steel, electrolysis, hydrometallurgy, heat transfer, heat conduction, and radiation. Principles of physical metallurgy, such as the effect of mechanical work and heat treatment, influence of impurities, etc. Calibration and use of instruments employed in metallurgical investigations, pyrometers, calorimeters, etc. Determination of efficiencies of furnaces. Experiments with electrochemical processes, electric furnaces, etc. *Prerequisites:* 243, 245. Fee, \$10. Second term (2).

257. **METALLOGRAPHY.** The study of metals and alloys; their physical, chemical, and microscopic properties together with deductions drawn therefrom. The influence of thermal and mechanical treatment on physical properties and structure. Lectures and laboratory work. Reference books: Gulliver's *Metallic Alloys*, Sauveur's *Metallography and Heat Treatment of Iron and Steel*. *Prerequisites:* 243, 245, 167, 168. Fee, \$10. First term (3).

258. **SEMINAR.** Conference hours of the staff of the department with students, to discuss current metallurgical literature, processes, and problems, and thesis work; involving reading of current English and foreign literature and verbal presentation by the students. Training in the preparation and writing of engineering reports. First term (3). Second term (2).

259. **THESIS FOR DEGREE.** Presentation by selected students in Metallurgy of a thesis on some topic which requires original literary and other research, such as observations, calculations, or experimental tests. Second term (4).

GEOLOGY

PROFESSOR MILLER, ASSISTANT PROFESSORS TURNER AND FRETZ,
DR. GILBERT

266. MINERALOGY. The principles of crystallography with practice in the determination of forms of models and crystals. The physical properties, origin, occurrence, association, and alteration of minerals. A study of about two hundred of the common mineral species and varieties, with practice in identification based on physical properties. Students should have had 390 and 391. Fee, \$5. First term (4).

267. BLOWPIPE ANALYSIS. A course in qualitative blowpipe analysis in which the chemical and physical behavior of the common chemical elements and their compounds is noted. Methods of rapid qualitative tests for the identification of minerals and chemical compounds with the aid of the blowpipe. Students should have had 390 and 391. Fee, \$2 each term. First and second terms (1).

268. GENERAL GEOLOGY. A course in dynamic, structural, and historical geology. Text-book, supplemented by illustrated lectures in which the relation of geology to engineering problems is discussed. Second term (2).

269. GEOLOGICAL LABORATORY AND FIELD TRIPS. The course consists of two kinds of work, one hour per week devoted to the macroscopic study of rocks and one hour to field trips. The field trips can be taken separately. When weather conditions prevent out-door work, laboratory exercises in the study of maps are substituted. The region furnishes excellent examples of varied structures and contains numerous quarries where slate, cement rock, limestone, sandstone, gneiss, and serpentine are obtained, all of which are visited by the classes. *Prerequisite:* 266, for laboratory work on rocks. Fee, \$1. Second term; (2) if both laboratory work on rocks and field trips are taken, or (1) if only field trips are taken.

270. NON-METALLIC ECONOMIC GEOLOGY. A study of the origin, modes of occurrence, properties, sources, production, and uses of the non-metallic mineral products. The major portion of the course is devoted to petroleum, natural gas, and coal. *Prerequisites:* 266, 268, 269. First term (2).

271. METALLIC ECONOMIC GEOLOGY. A study of the geological occurrence, distribution, uses, and commercial production of the metalliferous minerals. Includes consideration of the most important foreign districts. Recitations, illustrated lectures, field trips, and laboratory examination of ore specimens of representative districts of North and South America. Visits to the zinc mines of Franklin Furnace, N. J., and Friedensville, Pa., the magnetite mines of Dover, N. J., and Cornwall, Pa., and the anthracite coal regions. *Prerequisites*: 266, 268, 269. Second term (4).

272. PALEONTOLOGY. An elementary course in which the animal life of the past is considered from both the biological and geological viewpoints. Theories of the origin and evolution of life; principles of stratigraphy and paleontology. Study in the laboratory of index fossils of the successive geologic periods. *Prerequisites*: 268, 269. Second term (3).

273. STRATIGRAPHIC GEOLOGY. The geological age and geographical distribution of the rocks of the North American continent; the structure and history of its mountain ranges; the history of its geological development. For those who have not already had Course 272, a few weeks are devoted to a study of the characteristics and evolution of fossil forms. *Prerequisites*: 268, 269. Second term (3).

274. PHYSIOGRAPHY. The cosmic relations of the earth; the classification of land forms; the study of their origin, growth, and decay and the factors governing their development. Study of topographic and geologic maps. The relation of topography to geologic structure. The influence of physiography upon the economic development of countries. Brief study of weather and climate. Second term (2).

275. FIELD GEOLOGY. Practice in the actual mapping of surface geology, each student being assigned a definite area and required to make a report on the assigned area accompanied by a geological map with structure sections. Collection by each student of a full set of specimens to illustrate the geology. The first part of the course is devoted exclusively to field work, and the notes and specimens are studied in the laboratory when the weather prevents further out-door work. *Prerequisites*: 268, 269. Fee, \$1. First term (3).

276. **PETROGRAPHY.** The optical properties of minerals and their study with the petrographic microscope. Petrography of the most important igneous rocks. Lectures, recitations, and laboratory work. *Prerequisite:* 266. Fee, \$3. First term (2).

277. **PHYSIOGRAPHY.** A study of topographic forms and the processes that have produced them; the weather and climate; and the influence of physical conditions upon the development of countries. First term (2).

278. **PHYSIOGRAPHY.** A continuation of Course 277. Recitations, lectures, and laboratory work. Physiographic regions of North America and Europe. Topographic maps and the preparation of weather and climate charts. Second term (2).

279. **MINING AND GEOLOGIC LAW.** A study of the legal matters that confront a mining geologist. The law in regard to underground waters and mineral products. *Prerequisites:* 268, 269. First term (1).

280. **STRUCTURAL GEOLOGY.** The study of special features of structural geology in the field and laboratory. *Prerequisites:* 268, 269. First term (1).

281. **GEOLOGIC METHODS.** Methods used by the United States Geological Survey and by the mining companies that employ geologists. Special attention to the problems that confront an economic geologist in the investigation of coal lands, oil properties, metal mines, etc. *Prerequisites:* 268, 269, 275. Second term (3).

BIOLOGY

PROFESSOR HALL, ASSOCIATE PROFESSOR THOMAS, MR. OLD

290. **BOTANY.** A survey of the subject designed to give the student a general knowledge of plant life, morphology, physiology, and the classification of the vegetable kingdom. Type species are studied in the laboratory, and field trips are made to familiarize the student with plant habitats. Second term (3).

291. **FORESTRY.** Lectures, recitations, and laboratory work. A brief introduction to botany, followed by lectures on dendrology and text-book work on forestry. Laboratory work devoted mainly to dendrology and the characteristics of the wood of important timber species. Field trips during the autumn to enable the student to become familiar with the trees of the region. First term (2).

[Careful consideration has been given by friends of the University and by the Board of Trustees to the matter of forestry in connection with the conservation of our natural resources. It does not appear to the Trustees that the present demand for professional foresters is such as to justify the establishment of a school of forestry at the University. It does appear that the question is of such great and growing importance that the University should do its part toward calling the attention not only of its students but of the section of the country reached by the influence of the University to the need of a better knowledge of the principles involved. To this end courses of lectures have been instituted to which the public is invited and special instruction is given in forestry in certain of the curricula. In furtherance and support of the cause of Forestry the University has offered free tuition scholarships to graduates of the Pennsylvania State School of Forestry at Mont Alto, to pursue, as special students at this University, courses supplementary and cognate to their studies at Mont Alto.]

292a. BIOLOGY. Recitations from a text-book, laboratory work, and lectures on the following topics: (a) fundamental conceptions; life, protoplasm, the cell, etc.; (b) the more important biological theories; variation, heredity, evolution, etc. In the laboratory, types of the various phyla are dissected and drawings made. Fee, \$3. First term (3).

292b. BIOLOGY. An extension of 292a. The laboratory work consists of the detailed dissection of a mammal. Fee, \$3. Second term (3).

293. COMPARATIVE ANATOMY OF VERTEBRATES. Text-book work and recitations on the comparative anatomy of vertebrates. Laboratory work consisting of the dissection of types of the several vertebrate classes. *Prerequisite*: 292. Fee, \$3. Second term (3).

294. VERTEBRATE EMBRYOLOGY. Lectures, text-book, and laboratory work. Study of living, preserved, and sectioned material demonstrating the successive stages of cleavage, gastrulation, and the formation of organs. *Prerequisite*: 293. First term (3).

295. **SANITARY BIOLOGY.** Lectures, recitations, and laboratory work. Study of bacteria and allied microorganisms by staining and cultural methods; their sanitary importance in public water supplies. The bacteriology of sewage and sewage treatment. Qualitative and quantitative bacteriological and biological analyses of water and sewage. Fee, \$3. Second term (2).

296. **BACTERIOLOGY.** An elementary course in general bacteriology. Lectures, recitations, and laboratory work. After a general study of the morphological and cultural characteristics of bacteria and allied microorganisms, special attention is given to those forms of sanitary and economic importance. The role of bacteria, yeasts, and molds in fermentation industries, in the soil, and in disease is studied. Fee, \$3. First term (2).

297. **ADVANCED BACTERIOLOGY.** Recitations, laboratory work, and assigned reading. A thorough course in advanced laboratory technique. Pathological diagnostic tests for typhoid carriers, diphtheria, tuberculosis, etc., together with immunological reactions, such as the Wasserman test, Widal test, Shick test, etc., are studied in practice and theory. *Prerequisite:* 295, 296, or 299. Fee, \$3. Second term (2).

298. **PHYSIOLOGY.** A course in normal physiology, hygiene, and sanitation aiming to give that knowledge of the body and its functions which all should have. Emphasis on the application of such knowledge to personal hygiene and public sanitation. Second term (2).

299. **BACTERIOLOGY.** Recitations, lectures, and laboratory work. A more thorough course in elementary bacteriology than 296. Laboratory work includes special staining methods in the study of morphology; differential media in the study of bacterial physiology; and in general a more thorough study of the microorganisms themselves rather than their specific sanitary or industrial importance. The course is designed for Pre-medical students and others specializing in biological sciences. Fee, \$3. First term (3).

500a. **HYGIENE LECTURES.** A course of six lectures on personal and social hygiene, with the cooperation of the Director of the Student Health Service. Two lectures a week for the first three weeks of the first term. Required of all freshmen. First term ($\frac{1}{2}$ hour).

MINING ENGINEERING

PROFESSOR ECKFELDT, ASSOCIATE PROFESSOR BARTLETT

300. MECHANICAL DRAWING. Practice in lettering; use of instruments; projection drawings of simple machine parts; tracing and blueprinting; intersections and developments. First term (1). Second term (2).

300a. DESCRIPTIVE GEOMETRY. The power of visualization developed by the graphical solution of problems involving points, lines, planes, and solids, leading up to practical applications in the working of mine problems. First term (1). Second term (1).

301. MINING ENGINEERING; PROSPECTING. Modes of occurrence of minerals. Uses of geology. Prospecting for placers, veins, and beds. Magnetic prospecting. Drilling, sampling. Valuation of property. Location of claims. Patenting mining ground. BORING. Use of bore-holes. Methods: by percussion and rotation. Special methods. Shaft sinking by boring. Survey of bore-holes. EXPLOITATION. Location of plant. Rock drilling; tools and machines. Explosives; blasting; safety regulations. Shaft and slope sinking; tunneling. Supporting excavations by timber, metal, masonry, or concrete. Systems of mining underground and at the surface. HAULAGE. Surface and underground methods. Motors and cars, wire rope, aerial tramways. Loading and unloading; storage of minerals. Transportation of workmen. Signaling. First term (4).

302. ORE DRESSING. General principles and physical properties upon which the recovery of minerals or metals from ores is based, followed by detailed study of machines and apparatus used in modern practice for coarse and fine crushing; classifying and preparation for concentration; various methods of concentration, including gravity and magnetic methods, oil flotation, etc. Application of above methods to various ores; mill schemes or flowsheets. Study of procedure followed for treatment of ores and coal in typical modern concentrating plants. Mill location, construction, arrangement of machinery, operation and costs. Visits to mills and anthracite breakers.

ORE DRESSING LABORATORY. Experimental work and tests on ores, giving practical application of principles and processes covered. A well-equipped modern laboratory gives opportunity

for individual as well as class operation of the most approved machinery for the preparation of ores. *Prerequisite:* 266. Fee, \$5. First term (3).

303. MINING ENGINEERING. HOISTING. Motors, ropes attachments, receptacles. Safety appliances. Systems of hoisting. DRAINAGE. Surface water; prevention of access. Mine dams. Tunnel drainage. Mechanical drainage; water hoisting; pumping. Classes of pumps. VENTILATION. Atmosphere of mines. Pollution of air. Natural and mechanical methods of ventilation; systems. Types and efficiencies of ventilating machines. Instruments for testing air. Ventilating laws. LIGHTING. Methods employed. Safety lamps; electric lighting. Safety regulations. FIRST AID. Accidents; classes, causes. Means of prevention. Rescue work. Hygiene of mines; rules and laws. First aid to injured. RAILROAD CONSTRUCTION... Earthwork, trackwork, trestles, bridges, railroad structures, water tanks, yards. Second term (4).

304. MINE SURVEYING. Forms for keeping notes. Surface surveys. Determination of latitude, time, and azimuth from observations on Polaris and Sun. Connecting surface surveys with mine surveys through tunnels, slopes and shafts. Calculation of notes. Mine mapping. Mine problems. Practice in mine surveying.

RAILROAD SURVEYING. Preliminary and location surveys. Theory of curves. Railroad mapping. Calculation of earthwork. Curve and compensation problems. Practice in railroad surveying. *Prerequisite:* 165. Second term (3).

305. MINING ENGINEERING. CONSTRUCTION MATERIALS. The use of stone, brick, concrete, metal, and wood for foundations, piling, dams, reservoirs, retaining walls, mine buildings, railroads, trestles, tipples, ore bins, and docks. First term (3).

305a. MINE ADMINISTRATION. Organization, employment of labor, management; principles of mining. Second term (1).

306. OIL AND GAS TECHNOLOGY. Origin and distribution of petroleum and natural gas. General survey of the geological conditions surrounding their accumulation. Oil shales. Prospecting and mapping. Location of wells. Drilling; pumping. Special methods. Storage. Pipe lines. Tank cars. Second term (2).

307. MINING DESIGN. The design of parts of a mining plant to meet given conditions, with detailed working drawings, accompanied by estimates of material and costs. Structural steel and reinforced concrete design. *Prerequisites*: 167, 178. Second term (3).

308. PROSPECTING. Surface indications of minerals, including oil, gas, and water. Geological interpretation of strata and out-crops. Prospecting on surface and underground. Boring; magnetic prospecting. Mapping. Sampling and valuation of prospects. Locating and patenting claims. This course is offered as an elective for B.A. students. First term (2).

PHYSICS

PROFESSOR MAC NUTT, ASSOCIATE PROFESSOR FRY,

ASSISTANT PROFESSORS KLEIN AND JESSE,

MESSRS. CONCILIO, ZINSZER, CRAFTS, WEBB, SMITS, BREVOORT, JAMES

320. ELEMENTARY MECHANICS. Statics. Lecture demonstrations and recitations. *Prerequisite*: Plane trigonometry. First term (3).

321. ELEMENTARY MECHANICS. Dynamics. Heat. Lecture demonstrations and recitations. Second term (3).

322. PHYSICAL MEASUREMENTS. Laboratory and lectures. Fee, \$6. Second term (1).

323. ELEMENTARY PHYSICS. Electricity and magnetism. Lecture demonstrations and recitations. *Prerequisites*: 320, 321. First term (3).

324. PHYSICAL LABORATORY. Mechanics, heat, and electricity. *Prerequisites*: 320, 321, 322. Fee, \$6. First term (1).

325. ELEMENTARY PHYSICS. Light and sound. Lecture demonstrations and recitations. Second term (3).

326. PHYSICAL LABORATORY. Electricity, magnetism, light, and sound. *Prerequisites*: 322, 323, 324. Fee, \$6. Second term (1).

327. ADVANCED THEORY OF ELECTRICITY AND MAGNETISM. Lectures and recitations. Ferro-magnetism, electro-magnetism, induced electromotive force and inductance, magnetic properties of iron, electric charge and the condenser, electric field, potential, electric oscillation and waves. *Prerequisites*: 146, 147, 323. First term (2).

328. THEORY OF ELECTRICITY AND MAGNETISM; PYROMETRY AND PYROMETRIC MEASUREMENTS. Lectures and recitations. Ferromagnetism, electro-magnetism, induced electromotive forces and inductance, magnetic properties of iron, electric charges and the condenser, thermo-electricity, heat radiation theory, description and theory of pyrometric apparatus. *Prerequisites:* 146, 147, 323. First term (2).

329. ELECTRICAL LABORATORY. Precise measurements. *Prerequisites:* 322, 323, 324, 326. Fee, \$6. First term (1).

330. ELECTRICAL LABORATORY. Precise measurements. Continuation of 329. *Prerequisite:* 327 or 328. Fee, \$6. Second term (1).

331. ELEMENTARY PHYSICS. A brief general course. Lecture demonstrations, recitations, and laboratory. Fee, \$6 per term. First term (3). Second term (3).

332. MODERN PHYSICS. A non-mathematical account of the modern views concerning such subjects as the nature of matter, radio-activity, X-rays, etc. First term (2). Second term (2).

333. INTRODUCTION TO THEORETICAL PHYSICS. Mechanics, thermodynamics, the kinetic theory of gases, the wave theory of light, and the mathematical theory of electricity and magnetism. *Prerequisites:* 146, 147, 320, 321, 323, 325. First term (3). Second term (3).

334. LABORATORY PHYSICS. A laboratory course of advanced character to accompany Course 333. The experiments in general are designed to encourage originality on the part of the student. *Prerequisites:* 322, 324, 326. Fee, \$6 per term. First term (2). Second term (2).

335. ADVANCED ELECTRICITY AND MAGNETISM. The theory of electric oscillations, electric waves, and high frequency phenomena and measurements. *Prerequisite:* 333. First term (3).

336. LABORATORY PHYSICS. A laboratory course to accompany 335. *Prerequisite:* 334. Fee, \$6. First term (1).

337. PHYSICAL OPTICS AND SPECTROSCOPY. Elementary treatment of the wave theory of light, interference, diffraction, polarization, etc. Exposition of some phases of spectroscopic phenomena. *Prerequisite*: 333. First term (3).

338. LABORATORY PHYSICS. A course accompanying 337. *Prerequisite*: 334. Fee, \$6. First term (1).

339. ELECTRIC DISCHARGES THROUGH GASES. The properties of gaseous ions, the experimental data leading to the electron theory, including a study of vacuum tube phenomena, ionization and resonance potential, photo-electricity, etc. *Prerequisites*: 333, 335. Second term (3).

340. LABORATORY PHYSICS. A course accompanying 339. *Prerequisite*: 334. Fee, \$6. Second term (1).

341. HEAT. A theoretical study of thermodynamics and heat radiations. *Prerequisite*: 333. Second term (3).

342. LABORATORY PHYSICS. A course to accompany 341. *Prerequisite*: 334. Fee, \$6. Second term (1).

343. THESIS. The thesis which must be presented by each candidate for the Degree of Bachelor of Science in Engineering Physics will be based on one of the four courses offered in the senior year. First and second terms (4).

344. PHOTOMETRY AND ILLUMINATION. Lectures and recitations. Illumination standards, measurements of light and illumination, laboratory methods and devices, commercial methods and experiments, comparison of illuminants and illuminating devices, practical installations. *Prerequisite*: 325. First term (1).

345. THE TEACHING OF PHYSICS IN SECONDARY SCHOOLS. Principles of scientific method. A study of class room practice in neighboring schools. Text-books and methods. First term (2).

346. TELEGRAPHY. Practice in sending and receiving the Morse and International Codes based upon Western Union and U. S. A. Signal Corps practice. First term (1). Second term (1).

ELECTRICAL ENGINEERING

PROFESSOR ESTY, ASSOCIATE PROFESSORS SEYFERT AND SCHEALER,
ASSISTANT PROFESSORS BEAVER AND GRUBER,
MESSRS. MILLER, DIAMOND, AND HIBSHMAN

351. **ELECTRICAL DISTRIBUTION.** Systems of direct current distribution; wiring formulas and applications; installation of electrical machinery and apparatus; interior wiring; overhead and underground construction; rules and regulations of the National Board of Fire Underwriters. First term (2).

352. **DYNAMOS AND MOTORS.** Review of principles of electricity and magnetism with special reference to their application to the dynamo. The construction, operation, and control of direct current machinery; practical operation and management of dynamo machines; station equipment; cost of electrical energy; electro-magnets, magnetism of iron; characteristic curves; armature windings. Illustrative problems. *Prerequisites:* 323, 324. Second term (3).

353. **DYNAMO LABORATORY.** Introductory course supplementing the class work of 352. Experimental studies and tests of direct current generators, motors, and appliances, for characteristics, regulation, efficiency, insulation, etc. *Prerequisites:* 323, 324. Fee, \$6. Second term (1).

354. **DYNAMOS AND MOTORS.** An abbreviated course adapted to those students who do not continue this subject in the following year; the principles and practice of direct current engineering, including: the elementary theory, construction, operation, and control of direct current generators and motors, electromagnets, solenoids, automatic starters and controllers, station equipment, storage batteries. Illustrative problems. *Prerequisites:* 323, 324. First and second terms (2).

355. **DYNAMO LABORATORY.** Introductory course supplementing the class work of 354. Experimental studies and tests of direct current generators and motors for characteristics, regulation, efficiency, etc. *Prerequisites:* 323, 326. Fee, \$6. First and second terms (1).

356. **DYNAMO LABORATORY.** Continuation of 355, supplementing the class work of 361 or 375. Advanced testing of direct current machines; practice in operating and testing

alternating current apparatus. *Prerequisites*: 355, 354. Fee, \$6. First and second terms (1).

357. THEORY OF ALTERNATING CURRENTS. The elementary principles of alternating currents. Lectures, recitations, and problem work. *Prerequisites*: 146, 147, 326, 352, 353. First term (3).

358. DYNAMO LABORATORY. Continuation of 353. Advanced testing of direct current machines. *Prerequisites*: 352, 353. Fee, \$6. First term (1).

359. THEORY OF ALTERNATING CURRENTS. Continuation of 357. Advanced theoretical studies of alternators, synchronous motors, and synchronous converters. *Prerequisites*: 357, 358. Second term (2).

360. ELECTRICAL ENGINEERING. Application of physical and mathematical principles to the analysis and solution of problems relating to direct and alternating current circuits and apparatus; transient phenomena; use of complex quantities; non-harmonic periodic wave forms. *Prerequisites*: 327, 357. Second term (3).

361. ELECTRICAL ENGINEERING. A course particularly adapted to students who do not specialize further along electrical lines; systems of generation, transmission, distribution, and utilization are taken up in order. Under utilization special attention is given to the application of electric motors to various industries. Estimates and costs; problems. *Prerequisites*: 354, 355, 375. Second term (2).

362. DYNAMO LABORATORY. Continuation of 358. Advanced testing of direct current machines. Alternating current testing begun. *Prerequisites*: 357, 358. Fee, \$6. Second term (1).

362a. DYNAMO LABORATORY. Continuation of 356, consisting of advanced direct and alternating current studies and tests. A course designed for non-electrical students taking more than the usual two terms of dynamo laboratory. *Prerequisites*: 356, 375. Fee, \$6. Second term (1).

363. ALTERNATING CURRENT MACHINERY. Study of the structural details, characteristics, and operation of alternators, alternating current motors, rotary converters, and transformers; application of vectors. *Prerequisites*: 327, 359, 360. First term (4).

364. DYNAMO TESTING. Lectures on the methods of testing electrical machinery and apparatus, including direct current generators, motors, and motor generator sets. Special methods of testing large machines; experimental and commercial tests as carried out by the large manufacturing companies. *Prerequisites*: 327, 357, 358. Second term (1).

365. DYNAMO TESTING. Continuation of 364. Lectures on testing of alternating current machinery and apparatus, including generators, motors, rotary converters, transformers, induction regulators, etc. *Prerequisites*: 359, 362, 364. First term (1).

366. DYNAMO LABORATORY. Advanced experimental studies and tests of direct and alternating current generators and motors, synchronous converters, transformers, and auxiliary apparatus; measurement of power in polyphase circuits. *Prerequisites*: 359, 360, 362, 364. Fee, \$12. First term (3).

367. ELECTRICAL DESIGN. Application of electric, magnetic, and mechanical principles to the design of electromagnetic mechanisms, direct current generators, and motors; predetermination of characteristics and performance; armature windings. Lectures, recitations, problems, drafting. *Prerequisites*: 327, 359, 360, 362. First term (2).

368. ELECTRIC STATIONS. Consideration of prime movers; generating machinery, discussion of types and operation; auxiliary machinery and transformers; storage batteries and their application; switch-boards, measuring and protective devices; design and arrangement; station characteristics; substations; operation and management; visits to neighboring plants. *Prerequisites*: 170a, 222, 359, 362. First term (2).

369. ELECTRICAL ENGINEERING SEMINAR. A weekly meeting held in the department reading room for discussion of topics from the current journals of theoretical and applied electricity. Presentation of papers on assigned topics; new inventions and discoveries critically reviewed. *Prerequisites*: 357, 360, 362. First term (1).

370. ELECTRICAL DESIGN. Continuation of 367. Application of electric, magnetic, and mechanical principles to the design of alternating current machinery and apparatus; predetermination of characteristics and performance; armature

windings. Lectures, recitations, problems, drafting. *Prerequisites*: 363, 366, 367. Second term (2).

371. ELECTRIC TRACTION. The construction, equipment, and operation of different types of electric railways. The application of electric traction under steam railroad conditions; the dynamics of electric train movements; predeterminations of speed-time curves and the power required for different types of runs. Choice of car equipment; cost of construction and of operation. Testing of railway systems. Visits of inspection to power plants and required reports. An elective. *Prerequisites*: 363, 368. Second term (3).

372. ELECTRIC POWER TRANSMISSION. The long distance transmission of power by electricity for use in lighting, traction, mining, and manufacturing work. Mathematical determination of line constants, regulation, interference, transients, etc. Switching and protection of circuits; metering and methods of charging for power; recent practice in design and construction of lines and systems. *Prerequisites*: 375 or 363, 368. Second term (3).

373. ELECTRICAL ENGINEERING SEMINAR. Continuation of 369. Presentation and discussion of reports on thesis work. *Prerequisite*: 369. Second term (1).

374. DYNAMO LABORATORY. Continuation of 366. Advanced alternating current testing. *Prerequisites*: 363, 365, 366. Fee, \$12. Second term (2).

375. ALTERNATING CURRENTS. A course following Course 354; the principles and practice of alternating current engineering; the theory of alternating currents with applications to alternating current generators, motors, transformers, and other apparatus; systems of transmission and distribution; electric lighting. *Prerequisite*: 354. First and second terms (2).

376. SUMMER WORK. During the vacations following the sophomore and junior years each student in Electrical Engineering is required to spend at least eight weeks in getting practical experience at some approved shop or plant. A written report on the shop or plant, and the experience gained therein, is due September 23. These reports should contain such calculations, photographs, drawings, and plots as each individual case may require. Summer term (3).

377. THESIS FOR DEGREE OF E.E. Each candidate for the degree of Electrical Engineer may elect to present a thesis upon a subject chosen by the candidate during the first term of the senior year. The work upon which the thesis is based is done during the second term, and consists in part of reading from references furnished by the professor in charge, and in part of independent work in theory, experimental research, or designing. Reports of progress on thesis work are required from time to time during the term. Much importance is attached to the thesis as evidence of the candidate's ability to carry out an independent investigation. An elective. *Prerequisites*: 363, 366. Second term (3).

378. ELECTRICAL COMMUNICATION. A survey of the methods of electrical communication, principles of various systems of wire telegraphy, wire telephony, radio telegraphy and telephony, radio laboratory measurements, and radio practice. An elective. *Prerequisite*: 357 or 375. Fee, \$6. Second term (3).

379. ELECTRIC TRANSIENTS. An elective. A recitation, lecture, and laboratory course in elementary electric transients. It is designed to give a physical and quantitative idea of the more common transients occurring in electric circuits, apparatus, and transmission lines. Oscillograms of transients are obtained in the laboratory to substantiate the theory of the classroom. *Prerequisites*: 148, 363, 365, 366. Fee, \$6. Second term (3).

CHEMISTRY

PROFESSORS ULLMANN* AND BABASINIAN,

ASSOCIATE PROFESSORS DIEFENDERFER, CHAMBERLIN, AND LONG,
ASSISTANT PROFESSORS BECK, EWING, ANDERSON, OPDYCKE, AND
SINKINSON, MESSRS. SHIREY, BILLINGER, SMULL, WALDBAUER,
BOWMAN, AND THRUN

390. ELEMENTARY CHEMISTRY. Elementary phenomena and principles of chemistry. Lectures illustrated by experiments, diagrams, working drawings, and specimens from the museum. Note-books on the lectures required. Holmes' *General Chemistry*. First term (2).

* On leave of absence, 1924-1925.

391. CHEMISTRY LABORATORY. Experiments covering a systematic study of the chemical and physical properties of the more important elements and their compounds. Long, Chamberlin, and Buckley's *Experimental General Chemistry*. Deposit, \$15. First term (2).

392. CHEMISTRY LABORATORY. For B.A. students. Shorter course. Deposit, \$15. First term (1).

393. CHEMISTRY. A course for students who pass the examination in Elementary Chemistry held on the first Saturday of the term. Smith's *Intermediate Chemistry for Colleges*. *Prerequisite*: Satisfactory preparation in the rudiments of chemistry. First term (2).

393a. CHEMISTRY LABORATORY. Experiments designed to accompany 393. Long, Chamberlin, and Buckley's *Experimental General Chemistry*. *Prerequisite*: Satisfactory preparation in the rudiments of laboratory chemistry. Deposit, \$15. First term (2).

394. CHEMISTRY. Continuation of 390 or 393. *Prerequisite*: 390 or 393. Second term (1).

395. QUALITATIVE ANALYSIS. Practical work in the qualitative laboratory, accompanied by lectures and recitations. Baskerville and Curtman's *Qualitative Analysis*. *Prerequisites*: 390 and 391, or 393 and 393a. Deposit, \$25. Second term (2) or (3).

396. QUALITATIVE ANALYSIS CONFERENCE. Special consideration of science underlying qualitative analysis. Treadwell's *Analytical Chemistry, Vol. I*. *Prerequisites*: 390 and 391, or 393 and 393a. Second term (1).

397. STOICHIOMETRY. Chemical problems and reactions. Long and Anderson's *Chemical Calculations*. *Prerequisites*: 390 and 391, or 393 and 393a. Second term (1).

398. ADVANCED CHEMISTRY. Lecture course, with recitations. Theories of chemistry; physical and chemical methods of determining atomic and molecular weights, thermo-chemistry, dissociation, solution, catalysis, electrolysis, radio-activity, non-metallic elements and their compounds. Mellor's *Modern Inorganic Chemistry*. *Prerequisites*: 390 and 391, or 393 and 393a; 395, 397. First term (3).

399. ADVANCED CHEMISTRY. Lecture course, with recitations. Phase rule, solid solutions, metallic elements and their compounds. Readings in original literature. Mellor's *Modern Inorganic Chemistry*, Gulliver's *Metallic Alloys*. *Prerequisite*: 398. Second term (3).

400. QUANTITATIVE ANALYSIS. Practical work in the quantitative laboratory, accompanied by lectures and recitations. Acidimetry, alkalimetry, chlorimetry, and the determination and analysis of simple chemical compounds and ores. Treadwell's *Analytical Chemistry*, Vol. II. *Prerequisites*: 395, 396, 397. Deposit, \$30. First term (3).

401. QUANTITATIVE ANALYSIS. Practical work in the quantitative laboratory. Analysis of simple chemical compounds, ores, and metallurgical products. *Prerequisites*: 395, 397. Deposit, \$25. First term (3).

402. QUANTITATIVE ANALYSIS CONFERENCE. Lectures and recitations concerning the laboratory work of 400 and 401. *Prerequisites*: 395, 397; also 396 for B.S. IN CHEM. and CH.E. First term (2) or (1).

403. QUANTITATIVE ANALYSIS. Continuation of 401. *Prerequisite*: 401. Deposit, \$30. Second term (3).

403a. QUANTITATIVE ANALYSIS. Summer course arranged for students in Metallurgy. *Prerequisites*: 395, 396, 397. Deposit, \$40. (After September 1, 1925, a charge of \$10 per credit hour will be required for all summer courses whether optional or required.) Summer term (3).

404. QUANTITATIVE ANALYSIS. Continuation of 400. Analysis of minerals, ores, slags, and alloys, electrolytic analysis, etc. Treadwell's *Analytical Chemistry*, Vol. II. *Prerequisite*: 400. Deposit, \$30. Second term (2) or (3).

405. QUANTITATIVE ANALYSIS CONFERENCE. Lectures and recitations concerning laboratory work of 403 and 404. *Prerequisites*: 400 or 401; 402. Second term (2) or (1).

406. QUANTITATIVE ANALYSIS. Continuation of 404. Ores and alloys. Complete analysis of iron and steel; also gas analysis. Hillebrand's *Analysis of Silicate and Carbonate Rocks*, Lord and Demorest's *Notes on Metallurgical Analysis*, Hempel's *Gas Analysis*. *Prerequisite*: 404. Deposit, \$25. First term (2).

407. QUANTITATIVE ANALYSIS CONFERENCE. Discussions concerning the laboratory work of 406. *Prerequisite*: 405. First term (2) or (1).

408. ORGANIC CHEMISTRY. Lectures and recitations. A systematic survey of the typical compounds of carbon; their classification and general relations. Study of synthetic reactions. Bernthsen's *Organic Chemistry*, translated by Sudborough. *Prerequisites*: 399, 403 or 404; 405; for Pre-medical students, 395, 397. First term (3).

409. ORGANIC CHEMISTRY LABORATORY. Determinations of specific gravities, melting points, boiling points, vapor densities; qualitative and quantitative determinations of carbon, hydrogen, nitrogen, and the halogens. Preparation of pure organic compounds. Gattermann-Schober's *Practical Methods of Organic Chemistry*, Cohen's *Practical Organic Chemistry*. *Prerequisites*: The same as for 408. Deposit, \$20. First term (2).

410. ORGANIC CHEMISTRY. Continuation of 408. Lectures and recitations. *Prerequisite*: 408. Second term (4).

411. ORGANIC CHEMISTRY LABORATORY. Continuation of Course 409. Practical methods of saturation, nitration, reduction, diazotization, sulphonation, etc. Preparation of pure compounds. Study of the properties of dyes and other commercial products. Gattermann-Schober's *Practical Methods of Organic Chemistry*, Cohen's *Practical Organic Chemistry*. *Prerequisite*: 409. Deposit, \$40. Second term (3) or (2).

411a. ADVANCED ORGANIC CHEMISTRY. *Prerequisites*: 408, 409, 410, 411, with high grades. First term (2).

412. INDUSTRIAL CHEMISTRY. Engineering fundamentals, including machinery and materials of chemical plants, transportation of gases, liquids and solids, grinding, pulverizing, screening, filtration, evaporation, distillation, etc. Laboratory work includes the application of these fundamentals, with reports on various problems of chemical engineering. *Prerequisites*: 406, 407, 408, 410. Deposit, \$25. First term (3).

413. ASSAYING. Lectures and laboratory practice in the furnace assay of the ores of lead, tin, gold, and silver, and of gold and silver bullion. Cyanidization. Calculations for slag and slag mixtures. Lodge's *Notes on Assaying*. *Prerequisites*:

403 or 404; 405. Deposit, \$30. (After September 1, 1925, a charge of \$10 per credit hour will be required for all summer courses whether optional or required.) Summer term, four weeks, beginning June 8, 1925 (3).

414. ASSAYING AND INDUSTRIAL MINERALOGY. This covers much of the ground of 413. In addition there is instruction and laboratory work in Industrial Mineralogy, embracing about fifty minerals and rocks. It is intended primarily for students in Chemistry and Chemical Engineering. *Prerequisites*: 403 or 404; 405. Deposit, \$30. (After September 1, 1925, a charge of \$10 per credit hour will be required for all summer courses whether optional or required.) Summer term, four weeks, beginning June 8, 1925 (3).

415. INDUSTRIAL CHEMISTRY. Continuation of 412. Lectures, problems, and inspection trips on chemical processes and industries. *Prerequisite*: 412. Second term (3).

416. INDUSTRIAL ANALYSIS. Analysis of commercial products. Laboratory work. Allen's *Commercial Organic Chemistry*. *Prerequisites*: 410, 411. Deposit, \$10. Second term (3).

417. INDUSTRIAL ANALYSIS CONFERENCE. Lectures concerning the laboratory work of 416. *Prerequisites*: The same as for 416. Second term (1).

418. SANITARY CHEMISTRY LABORATORY. Qualitative and quantitative examination of drinking water and food-stuffs. *Prerequisites*: The same as for 416. Deposit, \$15. Second term (1).

419. PHYSICAL CHEMISTRY. Lectures and recitations. Lewis' *A System of Physical Chemistry*. *Prerequisites*: 147, 399, 403a; also 404, 405, 408, 409 for B.S. IN CHEM. and CH.E. First term (3).

420. PHYSICAL CHEMISTRY LABORATORY. Physico-chemical measurements. Findlay's *Practical Physical Chemistry*. *Prerequisites*: The same as for 419. Deposit, \$10. First term (1).

421. PHYSICAL CHEMISTRY. Continuation of 419. *Prerequisite*: 419. Second term (2).

422. PHYSICAL CHEMISTRY LABORATORY. Continuation of 420. *Prerequisite*: 420. Deposit, \$10. Second term (1).

423. RESEARCH CHEMISTRY. Advanced stage of study or an investigation approved by the Professor of Chemistry of some novel problem, involving exhaustive laboratory and library study. *Prerequisite*: All lower chemistry. First term (2) or (3).

424. RESEARCH CHEMISTRY LABORATORY. Continuation of 423. *Prerequisite*: 423. Deposit, \$15. Second term (2).

425. HISTORY OF CHEMISTRY. Chronological development of the science, with assigned reading. *Prerequisites*: 410, 411. Second term (1).

426. ELECTROCHEMISTRY. Chemical reactions in gases, solutions, and molten electrolytes caused by the electric current. Quantitative relations between electromotive force, electrical energy, and chemical energy. Efficiency and applicability of typical processes. *Allmand's Applied Electrochemistry* and incidental reading of references. *Prerequisites*: The same as for 419. First term (1).

427. ELECTROCHEMISTRY LABORATORY. Experimental study of electrochemical reactions. Current efficiencies. Electromotive force measurements and overvoltage. Transport numbers. Electrochemical preparations. *Prerequisites*: The same as for 419. Deposit, \$5. First term (1).

Deposits to cover breakage, chemicals, etc., are required as indicated above. The unused portion of the deposit is returned to the student.

MARINE ENGINEERING AND TRANSPORTATION

PROFESSOR CHAPMAN, MR. NOYES

450. SHIP CONSTRUCTION. An introductory course treating the various types of ships and methods of constructing steel and wooden ships. First term (2).

451. SHIP CONSTRUCTION. A continuation of Course 450, taking up details of ship construction, bow and stern construction, and special types of construction. During the course the student fairs a set of ship's lines. *Prerequisite*: 163. Second term (4).

452. NAVAL ARCHITECTURE. Displacement, stability, trim, launching, and strength of ships. The course is illustrated by numerous practical problems, and the student makes displacement and stability calculations by means of the integrator. *Prerequisite*: 147. First term (3).

453. NAVAL ARCHITECTURE. Resistance, powering, and propulsion; steering and maneuvering; and rolling of ships. A study is made of the effect of size, form and coefficients on the speed and power of ships; appendage resistance, models and model tanks; powering of paralleled bodied ships; propeller design and the influence of the hull on the action of the propeller. The work in rolling takes up a mathematical investigation of the rolling of ships in still water and among waves. Taylor's *Speed and Power Ships*. *Prerequisite*: 452. Second term (4).

454. MARINE ENGINEERING. The marine power plant and the layout of machinery on shipboard. Boilers, reciprocating steam engines, turbines, combination machinery, electric drive, and Diesel engines; fuels, combustion, draft and draft apparatus; condensing apparatus and ship auxiliaries. Chapman's *The Marine Power Plant*. *Prerequisite*: 218. Second term (4).

455. SHIP DESIGN. Lectures and drawing-room work. In this course and Course 456 each student carries through a design for assigned requirements which parallels the class room work. In this design he works up the dimensions, coefficients, displacement, estimated weights; stability under various conditions of loading; power and propeller requirements; accommodations and arrangement plans; freeboard, and bulkhead subdivisions; and cargo handling arrangements. Lectures covering the design of boats for inland water navigation. *Prerequisites*: 450 to 454. First term (3).

456. SHIP DESIGN. A completion of the work of Course 455. Lectures covering tonnage, yacht design, piping systems, maintenance, repairs, heating, and ventilation. In the drawing room the student draws up a set of lines and makes a machinery layout. *Prerequisite*: 455. Second term (3).

457. TERMINAL FACILITIES. A study of the loading and unloading of ships, cranes, piers, transit sheds, warehouses and

railroad facilities, and the other factors involving a quick "turn-around" of a ship in port. MacElwee's *Ports and Terminal Facilities*. *Prerequisite*: Junior standing. First term (2).

458. SUMMER WORK IN SHIP CONSTRUCTION AND MARINE TRANSPORTATION. During the summers following the sophomore and junior years, students are required to spend at least eight weeks in a shipyard or at sea (3).

459. SHIP OPERATION. A study of the engineering aspects of ship operation. The relation of size and speed of ships for the most economical performance in service; a study of the operating expenses of ships with different types of propelling machinery on various trade routes; influence of stevedoring costs and turn-around on profits; comparison of operating expenses of the steamship and the motor ship. Numerous practical problems. *Prerequisites*: 454 and 455. Second term (2).

460. MARINE ENGINEERING. A detail study of Diesel engines, Diesel auxiliaries; steam auxiliaries and evaporator plants. During this course the student carries through calculations for the auxiliaries for an assigned ship. *Prerequisites*: 218, 454 or 209. First term (3).

MILITARY SCIENCE AND TACTICS

MAJOR MC CAMMON, CAPTAINS CHANCE, CHALKER, CALLAHAN, AND RODMAN, AND SERGEANTS MOHRING, MC MANN, AND LAVIN

An infantry unit of the Reserve Officers' Training Corps was established at Lehigh University in September, 1919. Conducted on a voluntary basis during the year 1919-1920, the unit had a membership of 313 students. A year later the Trustees and Faculty of the University made the Basic Course (470 and 471), Military Science and Tactics, a required subject, under the R. O. T. C. regulations, for physically fit freshmen and sophomores. Provision for this training is made in their schedule of study.

The military courses contemplated under the War Department regulations consist of two years of basic work and two years of elective advanced work along specialized lines. A student taking the courses for four years becomes eligible, upon graduation, for a commission in the Officers' Reserve

Corps of the United States Army. Uniform and equipment are furnished by the Government. Musical instruments are also furnished to the members of the band. Each student to whom government property is issued is required to make a cash deposite of \$25.00, which deposit is refunded in full upon the return of the property in good condition; this deposit is payable at the time of registration for the fall term. During the advanced course students are paid commutation of subsistence, amounting to approximately \$10 a month.

470. BASIC COURSE, First Year. Fundamental military training common to all arms of the service. Three hours a week. Theoretical and practical instruction in the subjects: Marksmanship, military courtesy, military hygiene and first-aid, physical drill, command and leadership, and infantry drill regulations. (2) per term.

471. BASIC COURSE, Second Year. Fundamental military training common to all arms of the service. Three hours a week. The course consists of theoretical and practical instruction in the subjects: Scouting and patrolling, musketry, interior guard duty, automatic rifle, command and leadership, and infantry drill regulations.

Students who indicate suitable proficiency in this course are appointed Corporals in the R. O. T. C. Unit. (2) per term.

472. ADVANCED COURSE, First Year. Five hours a week. Theoretical and practical instruction in the subjects: Military sketching, military field engineering, infantry weapons (mahine gun), military law, rules of land warfare, command and leadership, and infantry drill regulations.

Students who indicate suitable proficiency in this course are appointed Sergeants in the R. O. T. C. Unit. (3) per term.

472a. SUMMER R. O. T. C. ADVANCED CAMP. Compulsory for students who elect the advanced course (3).

473. ADVANCED COURSE, Second Year. Five hours a week. Theoretical and practical instruction in the subjects: Infantry weapons (37 mm. gun and 3" trench motar), administration, military history and national defense act, combat principles, command and leadership, and infantry drill regulations.

Students who indicate suitable proficiency in this course are appointed Commissioned Officers in the R. O. T. C. Unit. (3) per term.

PHYSICAL EDUCATION

PROFESSOR REITER, ASSOCIATE PROFESSOR BALDWIN,
ASSISTANT PROFESSOR BARTLETT, MR. KANALY AND MR. GULICK

The aim of the Department of Physical Education is to insure the health and physical development of every student of the University. Facilities for accomplishing this aim are afforded in Taylor Gymnasium, the field house, and the two playing levels of Taylor Field.

Each student, upon entering the University, is given a physical examination. He is advised as to postural and physical defects.

All students are required to take regular exercise under Department supervision. This requirement calls for two hours a week in the gymnasium, or participation, under the oversight of the Director, in one of the following organized sports: football, cross country running, basketball, wrestling, swimming, soccer, track, lacrosse, tennis, and baseball. In addition numerous intramural contests are held. All students are urged and encouraged to participate in these activities. Members of the R. O. T. C. unit may substitute one hour of military drill for one of the two hours of required gymnasium.

500. GYMNASIUM. Class exercise in the open air, consisting of setting-up work for current carriage. Work with dumb bells, wands, and Indian clubs to stimulate circulation, respiration, and muscular action and to produce co-ordination and grace. Squad work on the heavy apparatus to develop strength in the larger muscles, recreative work in games and competitive exercises to develop the play and combative elements. The various drills and athletic dances are accompanied by music. Instruction in boxing, wrestling, swimming, fencing, golf, and personal defense. Corrective gymnastics are also given to those who have physical defects. The swimming course includes the various swimming strokes, fancy diving, and modern methods of life saving. A competent instructor is in charge. The measure of proficiency required of every student is swimming at least the length of the pool. Voluntary classes in advanced apparatus work. Talks are given to the freshmen on personal hygiene and the physiology of exercise. First and second terms; for freshmen and sophomores, ($\frac{1}{2}$); for juniors, seniors, graduate students (1).

Electives for Juniors and Seniors

The following courses are open only to juniors and seniors preparing themselves for professional careers in teaching and athletic coaching.

510. THEORY AND PRACTICE OF FOOTBALL. Under Preliminaries: Equipment, conditioning, passing in its various forms, blocking, tackling, following and falling on the ball, punting, dropkicking, place and goal kicking, methods of warding off and eluding the tacklers.

Under Offense: The advantages and disadvantages of the "Huddle System" vs. the old system of signals. The various systems of plays among the colleges.

Under Defense will be discussed the various systems in use and their application in the different zones of the field. The strategy of meeting open, closed, and split formations. Defense for forward passes, kicks, etc.

Next in order will follow team play, field tactics, coaching systems, individual positions, the coach and his personality, and the development of personality in players.

The place of scouting, planning the practice periods, play work, and fatigue. Special stress upon sportsmanship, ethical and educational factors relating to the game; considerable time will be spent on first aid and treatment of injuries, training, and personal hygiene. All through the course the discussion and interpretation of the rules will be taken up.

Three exercises in class room, one hour practical demonstration. Text book reading and discussion.

Second term (3).

511a. THE ORGANIZATION AND ADMINISTRATION OF PHYSICAL EDUCATION: Theory. This course will include a brief history of physical education. The theory of teaching, purpose and methods of instruction. Williams' *Organization of Physical Education*. Outside reading required. Second term (2).

511b. THE ORGANIZATION AND ADMINISTRATION OF PHYSICAL EDUCATION: Practice.

Calisthenics: Theory and practice of teaching. Freehand, dumbbell, wand, and Indian-club exercises.

Apparatus: Theory and practice of exercise on bars, rings, mats, bucks, horses, parallel bars, etc.

Mass Physical Activities: Participation and direction of mass games, athletics, and combative contests.

Dancing, Athletic and Folk: Elementary dance steps and simple folk games.

Individual Gymnastics: Theory and practice of exercises for the correction of physical defects. This course will include exercises for faulty posture.

Three hours practice (1).

512. THEORY AND PRACTICE OF BASKETBALL AND BASEBALL. Discussion in Basketball: Fundamentals, training, shooting, dribbling, passing, defense, offense, plays, rules, etc.

Discussion in Baseball: Fundamentals, batting, bunting, base running, play of the various positions, batting order, team play, signals, rules, etc.

One lecture and one hour of practical demonstration weekly. Second term (1).

513. THEORY AND PRACTICE OF SWIMMING. A course in the theory and practice of swimming from the instructor's point of view, to consist of one lecture and one hour of practical work in demonstrations, teaching, practice, each week. The salient subjects to be covered are as follows: history of swimming, its value in physical education, form swimming including the fundamental strokes, speed swimming, teaching beginners, analysis of dives and how to judge, life saving, water games, water carnivals, provisions for safety, duties and responsibilities, swimming equipment, fancy swimming, use of small boats, training for competitive swimming, and long distance swimming.

Elective. Two periods per week (1).

514. THEORY AND PRACTICE OF TRACK AND FIELD ATHLETICS. The theory of starting, sprinting, distance running and hurdling, high and broad jumping, pole vaulting, javelin, discus and hammer throwing, shot putting.

Practical discussion on preparation and training, including various styles of execution in the respective events, rules of competition, manner of promoting, managing and officiating at meets. This class will officiate at all home athletic meets.

Elective. Two (2) periods per week (1).

HISTORY AND GOVERNMENT

PROFESSOR GIPSON, ASSISTANT PROFESSOR BROWN

520. MEDIEVAL HISTORY (100-1150). The growth of the church; rise of the Papacy; the appearance of Empire; the monastic orders; Imperium and Sacerdotium; the Crusades; the growth of the French monarchy. Given in alternate years. First term (3).

521. MEDIEVAL HISTORY (1150-1500). The Hohenstaufens; the conquest of England; the rise of the schoolmen; the universities; trade and commerce; medieval literature, art, architecture, and ideals; the contribution of the Middle Ages to modern civilization. Not given in 1925-1926. Second term (3).

522. THE RENAISSANCE (1250-1450). The decline of the Middle Ages; revived study of the humanities; its influence on literature, art, religion, and society. Given in alternate years. First term (3).

523. THE REFORMATION (1450-1600). The revolt within the church; its spread to Germany; Luther; Melancthon; Calvin; the sixteenth century commercial revolution; nationalist tendencies. *Prerequisite: Medieval History, 520.* Second term (3).

524. MODERN HISTORY (1500-1925). General survey of European politics from the Empire of Charles V. to the outbreak of the French Revolution. To alternate with course 520. First term (3).

525. MODERN HISTORY. The Napoleonic and Metternichian eras; the nationalism of France; Germany, and Italy; colonial expansion; international relations since 1870. Second term (3).

526. THE FRENCH REVOLUTION. The precursors of the Revolution: Quesnay and the Physiocrats, the "Intellectuals," Montesquieu, Voltaire, Rousseau; social and financial chaos. To alternate with course 522. First term (3).

527. THE FRENCH REVOLUTION. The Revolution: political and constitutional changes; the spirit of the Jacobins; the Reign of Terror; reactions within France and beyond the Rhine; the submersion of the Republic in the Empire. *Prerequisite: General courses 520 or 524, or by permission.* Not given in 1925-1926. Second term (3).

528. HISTORY OF ENGLAND TO 1603. A study of Early Britain, the Anglo-Saxon Heptarchy and customs, the Norman Conquest, development of the parliament, continental wars, and the War of the Roses. To alternate with course 530. First term (3).

529. HISTORY OF ENGLAND TO 1603, CONTINUED. The Tudor Dynasty; the breaking-up of the medieval economy, the Reformation, rise of the middle class, mercantilism and the era of exploration. To alternate with 531. Second term (3).

530. HISTORY OF ENGLAND, 1603-1925. The Stuarts and the protectorate; the new social condition; conflict between king and Parliament; the Puritan Revolution; Cromwell and the Protectorate. To alternate with 528. First term (3).

531. HISTORY OF ENGLAND, 1603-1925, CONTINUED. Continental policy in the Eighteenth Century; the coming of Empire; the Industrial Revolution; political appearance of the cabinet; colonial expansion. To alternate with 529. Second term (3).

532. AMERICAN COLONIAL HISTORY. The period of discovery and exploration; rival settlements in North America of Spain, France, England, and Holland; the English colonial proprietors and the colonial charters; the growth of representative government; the beginnings of constitutional controversy. First term (3).

533. AMERICAN COLONIAL HISTORY. The establishment of parliamentary trade restrictions; colonial immigration, trade, and industry; western expansion and the collapse of the French empire in America; the new colonial system and its breakdown; the war for independence. Second term (3).

534. UNITED STATES HISTORY. The era of constitution making; the evolution of political parties; foreign relations during the wars of the French revolutionary period; the western movement and western state-building; the growth of sectionalism. First term (3).

535. UNITED STATES HISTORY. The war for the union; the reconstruction of the South; the era of big industry and labor combinations; the United States as a world power; the new national paternalism. Second term (3).

536. SENIOR SEMINAR. The seminar will be open to students of senior standing who desire to major in history and who have shown ability in one or more of the general survey courses. A brief period of history will be studied intensively. The subject for 1925-26 will be *Great Britain during the Period of the American Revolutionary War*. First and second terms (3).

550. ECCLESIASTICAL HISTORY: The Formative Period. Conditions in the Roman Empire; the Apostolic Age; the period of Heresies; the Ante-Nicene Fathers: Arius, Athanasius, and the Sabellians. The Council of Nicaea. First term (3).

551. ECCLESIASTICAL HISTORY: The Period of Growth. The rise of the Papacy; monasticism; Imperium and Sacerdotium; growth of Canon Law; the twelfth century heresies; the Reformation; Council of Trent; subsequent changes. Second term (3).

Attention is called also to the following courses offered in other departments: 47, Ancient Civilization, in the Department of Latin; and 38, Economic History, in the Department of Economics and Business Administration.

GOVERNMENT

542. AMERICAN GOVERNMENT (National). The evolution of the constitution; growth of the powers of the federal judiciary; the machinery of legislation; the scope of the federal administration. First term (3).

543. AMERICAN GOVERNMENT (State). Colonial basis of state government; the later state constitutions; the decline of the state legislatures; the new type of state administrations; state judicial systems; new forms of local government. Not given in 1925-1926. Second term (3).

544. POLITICAL SCIENCE. A brief survey of the chief exponents of political idealism; Aristotle and Plato, the Stoics, Seneca and Cicero, Aquinas and Marsiglio, Hobbes' *Leviathan*; Locke, Rousseau, Hume. Open to juniors and seniors, or by permission. First term (3).

545. COMPARATIVE GOVERNMENT. A study of the political organization of France, Germany, England, and the Dominions,

with especial reference to comparison and contrast with the government of the United States. *Prerequisite: American Govenment or Course 544.* First term (3).

546. INTERNATIONAL RELATIONS. The nature of inter-tribal or inter-state relations among the peoples of antiquity; the Greek world; the Roman Empire and its neighbors; the medieval church and international relations; diplomacy and the modern state. First term (3).

547. INTERNATIONAL LAW. The work of Grotius and his successors; the growth of substantive international law; the World War and international law; the building of machinery for the solution of international problems. Not given in 1925-1926. Second term (3).

GRADUATE COURSES

Courses leading to the degree of Master of Arts or Master of Science may, by permission of the Faculty, be pursued by any properly qualified person who has taken the Bachelor's degree or a degree in technology at any recognized college, university, or technical institution, subject to the following regulations:

(1) All work which is to be credited toward a master's degree shall be done in actual and regular attendance at the University.

(2) A minimum of 30 term hours is required.

(3) At least 18 of the required 30 term hours must be taken in one department. The remaining twelve hours will ordinarily be taken in one or two other departments; but the entire 30 hours may, with the approval of the Committee on Graduate Studies, be taken in a single department. In all cases, however, the work must be taken under at least two different instructors.

(4) A thesis may be required by the major department. If required, the thesis shall not count for more than 10 credit hours. Two bound typewritten copies of the thesis (one of which shall be an original copy) shall be submitted to the Faculty on or before May 15 of the year in which the degree is conferred.

(5) The Master's degree will not be granted unless the candidate has earned the grade A or B in at least three-fifths of his work. No course in which the grade earned is less than C will count towards the degree.

(6) Candidates employed as full-time teachers in the University or elsewhere may not take more than six hours of graduate work in any one term.

7. Tuition for graduate work will be charged on the basis of five dollars (\$5.00) per term hour.

When all requirements have been met, the candidate will be recommended by the Faculty to the Trustees for the Master's degree appropriate to the course pursued.

The following graduate courses are now offered by the University:

PHILOSOPHY, PSYCHOLOGY, AND EDUCATION

PROFESSOR HUGHES, ASSISTANT PROFESSOR DROWN

The following is the course that commonly is followed by those who select Education as the major study: Educational Psychology, 4 hours; School Administration, 4 hours; Secondary Education, 4 hours; Seminar in Education, with Thesis, 8 hours.

1. HISTORY OF PHILOSOPHY, Advanced course. (6)
2. PLATO. More's Platonism and the religion of Plato. (2)
3. THE PHILOSOPHY OF HISTORY. Augustine, Kant, Hegel, Comte, Spencer, Croce. The economic interpretation of history. The meaning of evolution. (4)
4. SPINOZA. (2)
5. THESIS IN PHILOSOPHY. (2 to 8).
6. EDUCATIONAL PSYCHOLOGY. (2 to 6)
7. SOCIAL PSYCHOLOGY. (2 or 4)
8. EDUCATIONAL MEASUREMENTS. (2 or 4)
9. SECONDARY EDUCATION. (2 or 4)
10. SCHOOL ADMINISTRATION: STATE AND COUNTY. (2)
11. SCHOOL ADMINISTRATION: CITY. (2)

12. EDUCATIONAL SOCIOLOGY. (2)
13. THE JUNIOR HIGH SCHOOL. (2)
14. CURRICULUM MAKING. (2)
15. THE PROJECT METHOD. (2)
16. SEMINAR AND THESIS IN EDUCATION. (2 to 5)
17. HISTORY OF EDUCATION. (4)

LATIN

PROFESSOR WRIGHT

The following group, consisting of three courses, one of which will be given each year, is offered for graduate students:

LATIN EPIGRAPHY. First term (1½).

TOPOGRAPHY AND MONUMENTS OF ANCIENT ROME. Second term (1½).

OVID's *Fasti*. Lectures, reading, and reports on the religion of ancient Rome. Two terms (3).

ROMAN EPIC. Lectures on the history of epic poetry. Intensive study of the *Aeneid* of Vergil and its sources. Two terms (3).

GREEK

PROFESSOR GOODWIN

GREEK POETRY. The development of poetry in Greece from Homer to the Drama, with special study of the Lyric Poets, and collateral reading. First and second terms (3). [Given in 1924-1925.]

GREEK PHILOSOPHY. The history of philosophic thought in Greece, particularly in the Pre-Socratic period. Ritter and Preller's *Historia Philosophiae Graecae*, and collateral reading. First and second terms (3). [To be given in 1925-1926.]

HELLENISTIC GREEK. Portions of the *Gospels* in a comparative study, the *Acts*, and selected *Epistles*. Thayer's *Lexicon*. Blass's *Grammar of New Testament Greek*. Patristic literature. Collateral reading. Selections from Lucian. First and second terms (3).

Other courses will be arranged from time to time, to suit as far as practicable the tastes of candidates.

GERMAN

PROFESSOR PALMER, ASSISTANT PROFESSOR MORE*

THE GERMAN DRAMA OF THE NINETEENTH CENTURY. First and second terms (3).

LESSING AS DRAMATIST AND CRITIC. First and second terms (3).

MIDDLE HIGH GERMAN. Wright's *Middle High German Primer*, Bachmann's *Mittelhochdeutsches Lesebuch*, *Nibelungenlied*. First term (3).

MIDDLE HIGH GERMAN. Gudrun, Wolfram von Eschenbach, Gottfried von Strassburg, Walter von der Vogelweide. Lectures on Middle High German literature. Second term (3).

ROMANCE LANGUAGES

PROFESSOR FOX, ASSISTANT PROFESSOR TOOHY

FRENCH

THE REALISTIC NOVEL IN FRANCE. Novels of Flaubert, Balzac, the de Goncourts, de Maupassant, Daudet, Zola, Mérimée. Reading and written reports on all books read. Lectures and discussion on the origin and development of the novel in France. The theory of Realism and Naturalism. Two terms (3).

FRENCH SOCIAL FORCES as exemplified in modern French Literature. First or second term (2) or (3).

OLD FRENCH. Grammar. Schwan-Behrens. Easier texts. *Chanson de Roland*. Two terms (3).

OLD PROVENÇAL. Reading and explanation of texts. Grammar; Grandgent. *Chrestomathie*; *Appel*. First or second terms (2) or (3).

ROMANCE PHILOLOGY. Sound change. Word formation. First or second term (2) or (3).

ROMANCE PHILOLOGY. Syntax. First or second term (2) or (3).

* On leave of absence 1924-25.

SPANISH

THE MODERN SPANISH NOVEL. Works of Galdós, Alarcón, Valera, Pereda, Valdés, Pardo Bazan, Ibáñez, Valle Inclán, Baroja. Reading, reports, and lectures. Two terms (3).

OLD SPANISH. Ford's *Old Spanish Readings*. First or second term (2) or (3).

ITALIAN

DANTE. *Inferno*. Lectures and outside reading. First or second term (2) or (3).

ENGLISH

PROFESSORS THAYER AND LUCH, ASSISTANT PROFESSOR MESCHTER

ENGLISH LITERATURE. An advanced course in branches which have not formed a part of the undergraduate work of the candidate, details to be arranged after a personal conference. Two terms (5). Professor THAYER.

ANGLO-SAXON. Anglo-Saxon poetry and prose above the grade of undergraduate work, from both the literary and the historical point of view. Two terms (5). Assistant Professor MESCHTER.

ENGLISH PHILOLOGY. An advanced course in the principles of Teutonic philology as applied to the origin and development of the English language. Two terms (5). Professor LUCH.

MODERN POETRY. Poetry of the Twentieth Century, matter, metre, and diction. Present tendencies. One term (5). Assistant Professor MESCHTER.

SANSKRIT. Beginner's Course. Perry's *Primer*. Lanman's *Reader*. Whitney's *Grammar*. Two terms (5). Professor THAYER.

MATHEMATICS AND ASTRONOMY

PROFESSORS THORNBURG, LAMBERT,* OGBURN; ASSOCIATE PROFESSORS STOCKER AND REYNOLDS; ASSISTANT PROFESSOR KNEBELMAN

PRACTICAL ASTRONOMY. The study of instruments and methods used in the determination of time, latitude, longitude, and azimuth; practical work in the observatory, to give facility in making and reducing observations. Two terms (5). Professors THORNBURG and OGBURN. *Prerequisites*: 141, 142, 147, 150.

* Deceased, February 15, 1925.

DIFFERENTIAL EQUATIONS. Based on Johnson's *Differential Equations* and Byerly's *Spherical Harmonics*. Collateral reading in the University Library. *Prerequisites:* 145, 146, 147. Two terms (3). Professor LAMBERT.

ANALYTIC MECHANICS. Elementary and Advanced Rigid Dynamics; Potential Functions, based on Love's *Theoretical Mechanics*; Williamson and Tarleton's *Dynamics*; and Routh's *Dynamics*. *Prerequisites:* 146, 147, 148, 149. Two terms (3). Associate Professor REYNOLDS,

DIFFERENTIAL GEOMETRY. Parametric representation of plane and skew curves and surfaces, theory of contact, curvature, differential invariants, intrinsic equations, trajectories, equations of Césaro, curvilinear coordinates, equations of Lamé. Representation of one plane upon another, conformal and spherical representation, equations of Gauss and Godazzi, theory of applicability. *Prerequisites:* 146, 147, 148. Two terms (2). Assistant Professor KNEBELMAN.

THEORY OF EQUATIONS. An elementary and advanced course in Theory of Equations, based on the treatise by Burnside and Panton. *Prerequisites:* 143, 144. Two terms (2). Associate Professor STOCKER.

INTEGRAL CALCULUS. A course in advanced Integral Calculus, including Elliptic Integrals, based on the works of Byerly and Williamson. *Prerequisites:* 146, 147, 148. Two terms (2). Associate Professor STOCKER.

VECTOR ANALYSIS. A course in the Theory and Methods of Vector Analysis as applied in physics and pure mathematics. *Prerequisites:* 146, 147. Two terms (2). Associate Professor REYNOLDS.

CIVIL ENGINEERING

PROFESSORS FOGG AND WILSON, ASSOCIATE PROFESSOR FULLER,
ASSISTANT PROFESSOR PAYROW

BRIDGE DESIGN. The theory of arched structures, with the preparation of general plans and estimates, and the economic comparison of different types. Two terms (4). Professor FOGG.

TESTING OF MATERIALS. The properties of materials of construction, with special reference to inspection and testing. Original researches by the student in the laboratory. Two terms (5). Professor FOGG, Associate Professor FULLER.

RAILROAD ENGINEERING. The economic location of railroads, as influenced by probable volume of traffic and cost of operation. A course based on Wellington's treatise, with discussion of special cases. Two terms (2). Professor WILSON.

SANITARY AND HYDRAULIC ENGINEERING. The designing of reservoirs, tanks, and pipe lines for water supply systems, and of sewers and other appurtenances for sewage systems. Inspection of existing plants, with reports thereon. Two terms (4). Assistant Professor PAYROW.

METALLURGY

PROFESSOR STOUGHTON, ASSOCIATE PROFESSOR ROUSH,
ASSISTANT PROFESSOR BUTTS

PROCESS IRON AND STEEL METALLURGY. Literary research followed by laboratory or plant investigations (or both) on improvements or innovations in the production, purification, or super-refining of iron and steel. Conferences and laboratory investigations. First and second terms (5) or (10). Professor STOUGHTON.

PHYSICAL IRON AND STEEL METALLURGY, HEAT TREATMENT, AND METALLOGRAPHY. Literary research followed by laboratory investigations on improvements in the physical properties of iron and steel or any of their alloys, or on methods of determining the physical properties. Conferences and laboratory investigations. First and second terms (5) or (10). Professor STOUGHTON.

MECHANICAL IRON AND STEEL METALLURGY. Literary research followed by laboratory or plant investigations (or both) on adapting or conforming the size and shape of iron or steel to the needs of industry. Conferences and laboratory investigations. First and second terms (5) or (10). Professor STOUGHTON.

PROCESS NON-FERROUS METALLURGY. Literary research followed by laboratory or plant investigations (or both) on improvements or innovations in the production, purification, or

super-refining of non-ferrous metals or their alloys. Conferences and laboratory investigations. First and second terms (5) or (10). Associate Professor ROUSH.

PHYSICAL NON-FERROUS METALLURGY AND METALLOGRAPHY. Literary research followed by laboratory investigations on improvements in the physical properties of non-ferrous metals or any of their alloys, or on methods of determining the physical properties. Conferences and laboratory investigations. First and second terms (5) or (10). Professor STOUGHTON, Assistant Professor BUTTS.

MECHANICAL NON-FERROUS METALLURGY. Literary research followed by laboratory or plant investigations (or both) on adapting or conforming the size and shape of non-ferrous metals or alloys to the needs of industry. Conferences and laboratory investigations. First and second terms (5) or (10). Professor STOUGHTON, Assistant Professor BUTTS.

ELECTROMETALLURGY. A study of the conditions of deposition of metals and alloys in electrolysis, electrolytic separations, formation of metallic compounds by electrolysis, energy absorption in electrolysis. Lectures and laboratory work. First term (5). Associate Professor ROUSH.

METALLURGICAL CONSTANTS. Study and determination of the melting points, vapor tensions, specific heats, and latent heats of fusion and of vaporization of metals, or alloys, from practical and theoretical viewpoints. The application of these and other thermo-chemical and thermo-dynamical constants of metals in quantitative metallurgical calculations. Conferences and laboratory investigations. First and second terms (5). Assistant Professor BUTTS.

GEOLOGY

PROFESSOR MILLER,

ASSISTANT PROFESSORS TURNER AND FRETZ,

DR. GILBERT

GEOLOGICAL INVESTIGATION. The investigation and study of the literature of some special geological problem. Field and laboratory work on some district; map of a limited area; an investigation of the microscopic character and general structural features of the rocks which are exposed; presentation of a

thesis or dissertation embodying these results. Preparation required dependent upon the nature of the problems to be studied. Two terms (4). Professor MILLER.

ECONOMIC GEOLOGY. Advanced work in ore deposits. Study of the literature and of the theories of ore deposition, together with detailed work on the type occurrences of some of the metallic or non-metallic minerals. Thorough investigation and report on some mining district with special regard to the origin of the ores and such commercial aspects of the deposits as may depend chiefly on the geology. *Prerequisites:* 270 or 271. Two terms (6). Professor MILLER and Dr. GILBERT.

PETROGRAPHY. A critical study of recent advances in petrographic methods and nomenclature. Preparation of a detailed report on a selected problem. *Prerequisites:* 266, 268, 269, 276. Second term (3). Assistant Professor TURNER.

PHYSIOGRAPHY. The detailed study of physiographic types and processes. Conferences, reports, and thesis, with work in the laboratory and field. *Prerequisite:* Training in elementary physiography and general geology. Two terms (4). Professor MILLER.

PHYSICAL CRYSTALLOGRAPHY. An advanced course in the geometrical and physical properties of crystals, with special reference to the Goldschmidt methods of crystal measurement and projection. First term (4). Assistant Professors TURNER and FRETZ.

BIOLOGY

PROFESSOR HALL, ASSOCIATE PROFESSOR THOMAS

HISTORY OF BIOLOGY AND BIOLOGICAL THEORIES. A course not involving laboratory work, being based on reading, seminars, and written reports. *Prerequisites:* At least 292 and preferably 293 and 294. First or second term (2).

VERTEBRATE HISTOGENESIS AND ORGANOGENESIS. Careful following, in the laboratory, of the development of a vertebrate, tracing of the history of the germ-layers, organs, and tissues. Organogenesis dealing with the association of tissues to form organs. *Prerequisites:* 292, 293, 294. First term (3).

INDUSTRIAL BACTERIOLOGY. An advanced course in Bacteriology including aspects of Industrial Chemistry in which bacteria play an essential part in the process, as in the manufacture of acetone, butyl alcohol, acetic and lactic acids, etc. The course also includes a study of the common contaminating organisms which cause commercial losses in the manufacture of sugar, leather, etc. *Prerequisite:* 296, or 299. First term (3).

BIOLOGICAL PRODUCTS. A lecture and laboratory course in the practical manufacture of vaccines, serums, and other substances used in immune therapy and the theory underlying their use. *Prerequisite:* 296, or 299. Second term (3).

ADVANCED BACTERIOLOGY. Course No. 297 may be taken as part of the minor requirement for the Master's degree.

MINING ENGINEERING

PROFESSOR ECKFELDT, ASSOCIATE PROFESSOR BARTLETT

METHODS OF MINING. The study of methods used in a given mining region, or in the production of a given class of material, with respect to conditions influencing choice of method and cost. Two terms (5). Professor ECKFELDT.

MINING PLANT. The determination of the efficiency of mining machinery of given types under varying conditions. Two terms (5). Professor ECKFELDT.

ORE-DRESSING PLANT. The study of certain operations incident to the dressing of ores or the preparation of coal. Determination of efficiency of machines and processes. Losses in dressing. Two terms (5). Associate Professor BARTLETT.

PHYSICS

PROFESSOR MAC NUTT,

ASSOCIATE PROFESSOR FRY, ASSISTANT PROFESSOR KLEIN

HEAT AND THERMODYNAMICS. The aim of this course is to present a comprehensive account of the science of heat and to develop the consequences of the two fundamental laws of thermodynamics. First and second terms (3) to (5).

THE THEORY OF ELECTRICITY AND MAGNETISM. An introductory discussion of the theorems in electrostatics of Gauss, Poisson, Laplace, and their application. Maxwell's theory of the electro magnetic field and electro magnetic waves followed by the electron theory of Lorenz as applied to electricity and magnetism. First and second terms (3) to (5).

THE THEORY OF LIGHT. A course covering the more important sections of geometrical and physical optics. First and second terms (3).

ELECTRON THEORY AND ATOMIC STRUCTURE. A study of the properties of the electron; wave and quantum theories of radiation and the structure of the atom. First and second terms (3).

PHYSICAL RESEARCH. Opportunity is afforded advanced students to pursue experimental investigations in physics. First and second terms (2) to (4).

ELECTRICAL ENGINEERING

PROFESSOR ESTY, ASSOCIATE PROFESSOR SEYFERT

THEORY OF ALTERNATING CURRENTS AND ALTERNATING CURRENT MACHINERY. A course based upon the works of Arnold, Bedell, and Crehore, Fleming, Steinmetz, and Lawrence. Two terms (4). Professory ESTY.

ELECTRICAL DESIGN. A course consisting of predeterminations by calculation of the characteristics, regulations, and performance of electrical machinery. Analysis and use of designing constants. Design of special machines. Two terms (3). Professor ESTY.

ELECTRIC TRACTION. The development of an electric railway project. Design of station and distribution system. Operating characteristics of direct and alternating current railway motors. Predetermination of motor equipment and run curves for given schedules and traffic. Choice of system. Estimates of cost. Two terms (3). Professor ESTY.

ELECTRICAL TESTING. Special experimental research in electrical engineering; tests of magnetic properties of iron and steel; investigation of the series single-phase alternating cur-

rent motor; leakage reactance of induction motors; regulation of alternators; polyphase testing; electric railway testing. Two terms (3). Professor ESTY, Associate Professor SEYFERT.

RADIO COMMUNICATION. The theory underlying the various sending and receiving systems, and the propagation of electromagnetic waves, combined with experimental work in connection with the department's wireless equipment. Two terms (2). Associate Professor SEYFERT.

CHEMISTRY

PROFESSORS ULLMANN* AND BABASINIAN,
ASSOCIATE PROFESSORS DIEFENDERFER, CHAMBERLIN, AND LONG,
ASSISTANT PROFESSORS EWING, OPDYCKE, AND SINKINSON

INDUSTRIAL CHEMISTRY. Investigation of a problem in chemical engineering or in industrial chemistry (4). Professor ULLMANN, Associate Professor CHAMBERLIN.

QUANTITATIVE ANALYSIS. Investigation of a problem in analytical chemistry (4). Professor ULLMANN, Associate Professor DIEFENDERFER.

ADVANCED ORGANIC CHEMISTRY. An advanced course in certain theories of organic chemistry. First term (2). Professor BABASINIAN.

CHEMISTRY OF DRUGS, DYES, AND RELATED COMPOUNDS. First term (2). Omitted in 1925-6. Professor BABASINIAN.

ADVANCED ORGANIC PREPARATIONS. Mainly a laboratory course. First and second terms (2). Professor BABASINIAN.

ORGANIC CHEMISTRY RESEARCH. Investigation of a problem in organic chemistry (4). Professor BABASINIAN.

ADVANCED INORGANIC CHEMISTRY (2). Associate Professor LONG.

COLLOID CHEMISTRY (2). Given in alternate years; omitted in 1924-5. Associate Professor LONG.

PHYSICAL CHEMISTRY METHODS. Advanced methods of physical chemistry laboratory practice (2). Assistant Professor EWING.

PHYSICAL CHEMISTRY RESEARCH. Investigation of a problem in physical chemistry (4). Assistant Professor EWING.

* On leave of absence, 1924-5.

THEORETICAL CHEMISTRY: KINETICS. Given in alternate years. *Prerequisites:* A good working knowledge of mathematics and the equivalent of undergraduate courses 419, 420, 421, 422 (2). Assistant Professor OPDYCKE.

THEORETICAL CHEMISTRY: THERMODYNAMICS. Given in alternate years; omitted in 1924-5. *Prerequisites:* A good working knowledge of mathematics and the equivalent of undergraduate courses 419, 420, 421, 422 (2). Assistant Professor OPDYCKE.

FUEL CHEMISTRY. Theoretical aspects and practice in the utilization of fuel, with the incidental methods of laboratory investigation (2). Assistant Professor SINKINSON.

FUEL CHEMISTRY RESEARCH. Investigation of a problem in the chemistry of coal (4). Assistant Professor SINKINSON.

The propriety of offering undergraduate courses in this department as a minor subsidiary to other courses will be adjudged in each case by the Department of Chemistry. The following undergraduate courses are sometimes accepted as minor subjects: Organic Chemistry of the junior year in the undergraduate curriculum, and the chemistry subjects of the senior year.

MARINE ENGINEERING

PROFESSOR CHAPMAN

ADVANCED SHIP DESIGN. Advanced work in the design of cargo and passenger ships. The relation of size and speed of ships for the most economical performance in service; a study from actual layouts of the relative merits of various types of propelling machinery; sub-division and flooding calculations according to the rules of the Bulkhead Committee of the Board of Trade. The design of special types of ships and sailing yachts. Two terms (5). Professor CHAPMAN.

THE POWERING AND PROPULSION OF SHIPS. An advanced course consisting of a study of powering and propeller data and a comparison of the work of various investigators. Two terms (2). Professor CHAPMAN.

THE STRENGTH OF SHIPS. Investigation of the stresses set up in a ship's structure with particular application to special types of construction. Two terms (3). Professors FOGG and CHAPMAN.

HISTORY

537. **ENGLISH INSTITUTIONAL HISTORY.** A study of political, social, economic, and religious institutions which have most profoundly influenced American civilization. Throughout the year (3). Not given in 1925-6.

538. **ENGLISH COLONIZATION IN NORTH AMERICA IN THE SEVENTEENTH CENTURY.** The activities of the great overseas trading companies; the problem of proprietarial control; the decline of the chartered colonies; conflicts between opposing political, economic, and religious ideals within the colonies. Throughout the year (3). Not given in 1925-6.

539. **AMERICA IN THE EIGHTEENTH CENTURY.** The workings of the English mercantile system; the evolution of colonial institutions; the international struggle for the fur trade in North America; George III and the new administrative system. Throughout the year (3).

540. **AMERICAN CONSTITUTIONAL HISTORY.** The major problems involved in the growth of the powers of the national government will be studied. Throughout the year (3). Not given in 1925-6.

541. **AMERICA AS A WORLD POWER.** The relations of the United States with Latin America; the problem of the Pacific; the United States and Europe. Throughout the year (3). Not given in 1925-6.

EXTENSION COURSES

At the request of a suitable number of applicants who are prepared for the work, the University will give such extension courses in Bethlehem as can be given without sacrifice of the time and energy that are demanded for the instruction of matriculated students in the University.

Graduates of any first-class high school, either men or women, are admitted to these extension courses. The fee is \$10 per credit hour. Extension course certificates are issued to those who complete any course, and the records of all work completed are kept for reference in the University files.

THE SUMMER SESSION

Beginning with the summer of 1924 the various courses formerly given during the summer were by Faculty action combined in a Summer Session administered by a Director of the Summer Session and by a faculty consisting of those teaching in that Session.

All Summer Session courses are conducted in accordance with the same standards, and may be credited towards a degree on the same basis, as courses given in the Fall and Spring Terms.

Following is a list of the courses given in 1924. For detailed descriptions of these courses, see pages 89-145 above.

Courses of Four Weeks, Beginning June 11, 1924

COURSE NO.	COURSE TITLE.	CREDIT HRS.
165.	Land and Topographic Surveying	(5)
225.	Calorimetry	(3)
413.	Assaying	(3)
414.	Assaying and Industrial Mineralogy.....	(3)

Courses of Eight Weeks, Beginning June 11, 1924

2.	Educational Psychology.....	(3)
3.	Advanced Educational Psychology.....	(3)
10b.	Great Books of the Past Decade.....	(3)
12.	History of Education.....	(3)
20.	Accounting (first term).....	(3)
38.	Industrial History (first term).....	(4)
70.	Elementary German.....	(3)
71.	Elementary German, continued.....	(3)
94.	Advanced French (second term).....	(3)
110.	Beginning Spanish (second term).....	(3)
112.	Second-Year Spanish (second term).....	(3)
120.	Rhetoric	(2)
121.	American Literature.....	(1)
122.	English Literature.....	(2)
140.	Solid Geometry.....	(3)
141.	Trigonometry	(3)
143.	Advanced Algebra.....	(4)
145.	Plane Analytic Geometry.....	(3)

146. Differential Calculus.....	(4)
147. Integral Calculus.....	(4)
148. Differential Equations.....	(1)
149. Analytic Mechanics	(2)
320. Elementary Mechanics	(3)
321. Mechanics and Heat	(3)
322. Physical Measurements	(1)
323. Electricity and Magnetism.....	(3)
324. Physical Laboratory	(1)
326. Electricity and Magnetism Laboratory.....	(1)
351. Electrical Distribution	(2)
352. Dynamos and Motors.....	(3)
353. Dynamo Laboratory	(1)
375. Alternating Currents	(2)
390. Elementary Chemistry	(2)
391. Elementary Chemistry Laboratory.....	(1)
393. Elementary Chemistry	(2)
393a. Elementary Chemistry Laboratory.....	(1)
394. Elementary Chemistry, continued.....	(1)
395. Qualitative Analysis.....	(3)
396. Qualitative Analysis Conference.....	(1)
397. Stoichiometry	(1)

Course of Two Weeks, Beginning July 7, 1924

166. Railroad Surveying	(2½)
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Course of Four Weeks, Beginning July 7, 1924

304. Mine and Railroad Surveying.....	(5)
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Courses of Six Weeks, Beginning July 7, 1924

3. Advanced Educational Psychology.....	(3)
4. Clinical Psychology	(3)
15. Problems of Secondary Education.....	(3)
156. Methods in Mathematics.....	(3)
401. Quantitative Analysis	(3)
402. Quantitative Analysis Conference.....	(1)
403. Quantitative Analysis, continued.....	(3)
404. Quantitative Analysis Conference, continued....	(1)
403a. Quantitative Analysis (the equivalent of 401, 402, 403, and 404).....	(8)

THE SUMMER SESSION OF 1925: ANNOUNCEMENT

The Summer Session of 1925 will begin July 6 and end August 19 (six weeks and three days).

One hundred and six courses will be offered, including:

I. Courses for teachers of (a) Social Science and History, (b) Natural Science, (c) Mathematics, (d) English, (e) Special Classes (and teachers interested in the study of individual differences).

II. Courses in Social Science and History. *A three-year cycle of courses in this field has been planned, with special reference to the needs of candidates for the State Certificate in Social Science and History.*

III. Courses in Humanistic Studies and Literature: Philosophy, Education, Psychology, English, Latin, Greek, German, French, Spanish.

IV. Courses in Natural Science: Geology and Mineralogy, Biology, Physics, Chemistry.

V. Courses in Mathematics.

VI. Engineering courses, required as summer work in certain technical curricula of the University: Surveying (June 8-July 4, at Saylor's Lake), Assaying (June 8-July 4), Mechanical Engineering Laboratory (June 8-July 4), Electrical Engineering (July 6-August 19), Engineering Drawing (July 6-August 19).

For a special circular giving full descriptions of these courses and information in regard to admission, fees, etc., address: Professor Percy Hughes, Director of the Summer Session, Lehigh University, Bethlehem, Pa.

**EVENING SCHOOL OF BUSINESS
ADMINISTRATION**

The Evening School of Business Administration is maintained for the purpose of giving instruction of college grade to men who have not had an opportunity to do college work, who have not completed their college courses, or who have not had business courses in their college work. The primary aim is to offer courses of practical value to employees of in-

dustrial enterprises, mercantile establishments and banks and to others whose efficiency and prospects of advancement would be improved by the broadening influence of a serious study of the fundamental principles of business.

The courses offered are in scope and character equivalent to those given in the regular work of the University and are taught by members of the University staff or by specialists engaged because of their abilities.

The year's work, which begins in September and ends in May, is divided into two terms, the courses given in the second term being a continuation of the corresponding courses of the first term.

A statement of courses completed is given to all students. A special certificate from Lehigh University is granted to students who have completed eight one-year courses. A student who is qualified for admission to the regular work of the University and enters the University as a regular student will receive credit toward his University degree for all courses completed in the Evening School.

Details regarding fees, hours, and admission requirements may be obtained on application to the Dean of the University.

The courses offered for the year 1924-5 were as follows:

BUSINESS ECONOMICS. An examination of economic principles and their application to business. The course covers such economic questions as prices and price levels, real incomes and money incomes, laws of supply and demand, large scale production, money and exchange, business prosperity and depression, and trade and tariffs.

ELEMENTARY ACCOUNTING. The fundamentals of accounting, with sufficient problem and practice work to illustrate the principles. Theories of debit and credit, single and double entry, analysis of financial statements, and principles of depreciation are covered.

CORPORATION ACCOUNTING. The application of accounting principles to corporations. Construction and analysis of corporation statements, capital accounts, various forms of indebtedness, surplus and reserves, sinking funds, liquidation, and other aspects of corporation accounting are considered.

INVESTMENTS. This course takes up the underlying principles of corporation financing, the types of corporation securities, speculation as contrasted with investment, the work of Wall Street, bucket shops, and fraudulent promotions. Special study is given to the various types of government and corporate bonds and stock issues.

BUSINESS LAW. A study of the essential principles of commercial law, with special reference to contracts, agency, negotiable instruments, bankruptcy, and sales.

MONEY AND BANKING. The first term's work is designed to give the student a knowledge of the facts and laws of money, with special attention to standards, paper money, and the history of United States money. The second term's work covers the principles of banking, with special reference to the Federal Reserve system.

INCOME TAX. A study of the practical problems arising in connection with the Federal Income Tax and the Federal Inheritance Tax as they operate under the laws of 1924 and previous years. This course is designed to cover the actual questions individuals and business concerns meet in settling their obligations to the government.

BUILDINGS AND GROUNDS

The University occupies nineteen buildings, and its grounds cover 180 acres on the north side of South Mountain, overlooking the valley of the Lehigh River and the city of Bethlehem.

PACKER HALL

Packer Hall, completed in 1869, is four stories in height, 215 feet long, and 60 feet wide. It is built of Potsdam sandstone in the English Gothic style of architecture.

The Department of Civil Engineering occupies the greater part of the first and second floors of Packer Hall. On the first floor are a lecture room, two recitation rooms, a large drawing hall, two instrument rooms, two offices, and a library room. The instrument rooms contain seventeen transits, fourteen levels, a large geodetic theodolite, two plane tables, and other instruments for engineering field

work. In the library room is a collection of plans of engineering structures. On the second floor are two drawing-rooms, three recitation rooms, an instrument room, a blue-print room, and offices.

On the third and fourth floors are to be found the offices and recitation rooms of the Department of Mathematics and Astronomy.

In the basement are located the store rooms and gallery range of the Department of Military Science and Tactics.

The offices and class rooms of the Department of Philosophy, Psychology, and Education are on the first and second floors of Packer Hall.

THE WILLIAM H. CHANDLER CHEMICAL LABORATORY

The Chemical and Metallurgical Laboratories are contained in a fire-proof sandstone building, 259 feet in length by 44 in width, with two wings, each 62 feet in length by 42 feet in width.

In the Chemical department there are two principal stories, a basement, and a topmost story given over to the laboratory for physical chemistry. The upper floor is occupied by the quantitative and the qualitative chemical laboratories. These rooms are 22 feet in height, and are well lighted and ventilated. Laboratories for research chemistry and the supply room are also on this floor.

The first floor contains a large lecture room, a smaller lecture room, a recitation room, a chemical museum, and laboratories for organic chemistry and sanitary chemistry.

In the basement is a large laboratory for the furnace assay of ores and a well-appointed laboratory for gas analysis; also rooms containing the apparatus for processes in industrial chemistry, steam engine and dynamo and motor installation, air pump for pressure and vacuum filtration, etc.

The University has recently completed an extension of the Chemical Laboratory. It is three stories high, in architectural conformity with the main building, and has inside dimensions of 60 feet by 37 feet.

The Metallurgical department contains a lecture room; a museum of metallurgical collections; an extensive departmental library; a dark room for photographic work; a laboratory provided with a spectroscope, two Le Chatelier and one Leitz metallographic microscopes complete with camera; a dry laboratory provided with gas and electric furnaces, and electric current for electrometallurgical experiments. Equipment is provided for laboratory work in metallurgy, metallography, and particularly in electrometallurgy, consisting of gas, electric current, and apparatus for various kinds of experimental work. Several new pyrometers, calorimeters, and furnaces have been added recently to the general equipment. This department is therefore equipped for the instruction of classes in metallurgy and electrometallurgy of the regular curriculum, to afford facilities to students for familiarizing themselves with the methods of measurement and research employed in metallurgy and electrometallurgy, and for conducting original investigation in these departments of science.

The Trustees of the University named this building the William H. Chandler Chemical Laboratory in recognition of Dr. Chandler's thirty-five years' service as Professor of Chemistry, 1871-1906.

THE PHYSICAL AND ELECTRICAL ENGINEERING LABORATORY

The Physical and Electrical Engineering Laboratory is 240 feet long, 44 to 56 feet wide, and four stories high. The halls and stairways, the photometer rooms, and all apparatus rooms are of fire-proof construction. The remainder of the building is of heavy mill construction.

On the first floor are the Advanced Electrical Laboratory and shops of the Physics Department, the senior and junior dynamo laboratories, the shop and research room of the Electrical Engineering Department, and a storage battery room belonging jointly to the Departments of Physics and Electrical Engineering.

The dynamo laboratory for senior students in the west wing is supplied with power from a 75-kilowatt rotary converter receiving current from the University power plant through two 30-kilowatt transformers. The dynamo laboratory equipment, which is being constantly increased, now includes the following apparatus: an 18-kilowatt double current generator, two direct current motor-generator units, one Lincoln variable speed motor, a 4-kilowatt Westinghouse two-phase rotary converter, a 10-kilowatt General Electric six-phase compound rotary converter, two direct connected units consisting of $7\frac{1}{2}$ -kilowatt six-phase General Electric alternators driven by 15-horse power Allis-Chalmers motors, one 20-kilowatt two- (or three-) phase alternator built by the Department, a 35-kilowatt Westinghouse single-phase alternator, a 10-kilowatt composite wound alternator driven by a 15-horse power Crocker-Wheeler motor, a pair of 3-horse power direct connected series crane motors, three motor-generator sets converting from alternating to direct current, four polyphase induction motors ranging from 2-horse power to $7\frac{1}{2}$ -horse power, three types of single-phase induction motors, two single-phase commutator motors, twenty-two transformers of from 1 to 15-kilowatts, including two 15-kilowatt Scott-connected transformers, a 5-kilowatt 66,000-volt testing transformer, a 6-light constant current transformer, a 30-ampere arc rectifier outfit complete, a General Electric oscillograph outfit, a Crane lecture room oscillograph, and a variety of instruments, including voltmeters, ammeters, watt-meters, rheostats, contact makers, frequency meters, dynamometers, condensers, and other apparatus.

The dynamo laboratory for junior students on the first floor in the west wing contains the following apparatus: a 20-kilowatt Ferranti alternator driven by a direct current motor, two arc light machines, twenty arc lamps of various types, a Brackett cradle dynamometer, a Westinghouse two-phase rotary converter, a motor driven battery-booster set, several types of adjustable speed motors, and other motors for direct and alternating currents.

On the second floor are the offices of the Departments of Physics and of Electrical Engineering, two general apparatus rooms, a large laboratory room for Physics, the Library of the Department of Physics and a small research laboratory, a large dynamo laboratory for sophomore students in Electrical Engineering, and an Electrical Engineering reading room. The dynamo laboratory for sophomore students in the west wing is equipped with twenty-seven direct current machines of various types, dynamotors, and several types of automatic starters and auxiliary apparatus. Apparatus exemplifying the operation of telegraph, telephone, and radio telegraph and telephone stations are here installed. The equipment in radio telegraphy and telephony includes a 250-foot antenna, 5-kilowatt transformer, oscillation transformer, a 3000-volt direct current generator, quenched gap, and several sets of receiving apparatus.

On the third floor are the lecture room, apparatus rooms and photometer rooms of the Department of Physics, and the lecture room, recitation rooms, apparatus room, and radio laboratory of the Department of Electrical Engineering.

On the fourth floor are recitation rooms and two large laboratory rooms of the Department of Physics.

THE W. A. WILBUR ENGINEERING LABORATORY AND POWER HOUSE

The W. A. Wilbur Engineering Laboratory was erected in 1902; in 1907 the original building was doubled in size, the addition containing the new heating and lighting plant of the University. The building is of sandstone, conforming in material to the adjacent Chemical and Physical Laboratories. It is 44 feet wide by 188 feet long, one story high in the boiler room, but with a raised engine room forming a second story at either end.

The boiler equipment of the laboratory consists of two water-tube boilers rated at about 100-horse power each, one of Babcock & Wilcox, the other of Sterling type. In the heat and light plant there are three 250-horse power

Sterling boilers, with room for a fourth unit of equal or greater capacity. Each section has its own set of feed pumps and other auxiliaries, in the arrangement of which special provision has been made for easily conducting performance tests. The laboratory boilers are connected to the chimney of the old boiler house, and have also an induced draft outfit. The chimney of the newer plant is of radial brick construction, 125 feet high, and a forced draft equipment is to be installed when need for increased capacity arises.

A coal-storage yard north of the building has room for a season's supply of coal, and a system of belt-conveyors and bucket-elevators is provided for receiving coal, dumping it on storage pile, and conveying it into the boiler room as needed.

The engine room of the laboratory, 50 feet long, contains a vertical triple-expansion engine of 75-horse power, a 60-horse power compound two stage Ingersoll air compressor, a small tandem-compound yacht engine, a simple Ball engine direct connected to a 25-kilowatt Crocker-Wheeler generator, and a 5-horse power De Laval steam turbine. There is also a complete set of Westinghouse airbrake apparatus, with four freight car brakes. The airbrake pump and all the other small motors, including the feed and condenser pumps, are piped to the surface condensers beneath the engine room floor. There are two large condensers of 150- and 60-horse power capacity respectively, with smaller ones for the pumps and for special experiments. Besides the various engines there are a large belt dynamometer, apparatus for testing gases, indicators, thermometers, steam calorimeters, and other instruments, and for experiments on flow of steam, for testing injectors, etc. The exhaust system includes a Cochrane feed-water heater of 250-horse power capacity.

The engine room of the power house is 31 feet long, with concrete floor. The generating units now installed are of 50- and 100-kilowatt rating, and there is room for a third of larger size. Simple horizontal Ball engines are direct

connected to General Electric alternating current generators, which furnish 60-cycle two-phase current at 2200 volts for transmission to the various distributing centers. An engine-driven and a motor-driven exciter, with the switchboard, complete the electrical equipment. The engines exhaust through a Cochrane heater, and the exhaust steam may be discharged directly into the low-pressure system during the heating season.

A floor space of 45 feet by 70 feet in the old boiler house is now used as a laboratory. It contains a 150-horse power suction gas producer for anthracite coal and apparatus for gas-power engineering and hydraulics, and for minor thermodynamic experiments with steam.

This building bears the name of Mr. W. A. Wilbur in grateful recognition of the work he has done for Lehigh University.

WILLIAMS HALL

Williams Hall was the donation of Dr. Edward H. Williams, Jr., of the Class of '75, and was so named by the Trustees of the University not only in recognition of this gift but also of Dr. Williams' long continued and important service to the University as an alumnus and as Professor of Mining and Geology.

Williams Hall is 186 feet long by 70 feet wide and covers a ground area of over 12,000 square feet. One-half of the building is devoted to the Department of Mechanical Engineering and the other half to the Departments of Geology and Biology.

In the eastern end there are recitation rooms, instructors' offices, drawing rooms, reference library, and store-rooms of the Department of Mechanical Engineering, and in the basement rooms and apparatus are provided for laboratory work in experimental mechanics and engineering physics, such as the calibration of the measuring instruments used in mechanical engineering, the determination of the mechanical efficiencies of hoisting and other gear, and the testing of motors. In this section there are electric motors, a water motor, a 15-horse power centrifugal pump, hoists, blocks, jacks, and dynamometers of various kinds.

In the west end the Department of Geology has on the first floor two lecture rooms, two offices, library, mineralogical museum, and laboratory of petrology and petrography. The lecture rooms contain specimens of rocks and fossils and a collection of economic minerals and ores. The main lecture room is fitted with a stereopticon for illustrated lectures. The laboratory of petrography is provided with fifteen high-grade petrographic microscopes and study collections of rocks and minerals. The collection of rocks contains over six thousand specimens from type regions in different parts of the world. The mineralogical museum contains many valuable collections representing all the prominent mineral localities in the world. In the basement are the mineralogical laboratory, the blowpipe analysis laboratory, a small chemical laboratory for analytical work, and a room fitted with apparatus run by a one-horse power motor for cutting thin sections of rock. On the second floor is the paleontological museum, which contains the fossil collections. On the third floor is a room fitted as an office and laboratory, containing a Goldschmidt two-cycle goniometer and other apparatus for advanced work in crystallography.

On the third floor there are the drawing room and an office of the Mining Department, also well-equipped blueprint and dark rooms and a photographic laboratory used jointly by the Departments of Mining Engineering and Geology.

The Department of Biology has its lecture room, office, reference library, laboratories, and store rooms on the second floor, and a large vivarium on the third floor. The laboratories of this Department are thoroughly equipped with collections, sections, microscopes, and necessary appliances.

Two students' rooms, used by the Mining and Geological Society and by the Mechanical Engineering Society, are located in the basement.

THE FRITZ ENGINEERING LABORATORY

The late John Fritz, of Bethlehem, known as the father of the steel industry in the United States, and a member of the Board of Trustees dating from the founding of the University, gave to the University the funds for the erection and thorough equipment of an engineering laboratory. The building was designed and erected in 1910 under the personal supervision of Mr. Fritz. The building is equipped with a general testing section for testing iron and steel, a cement and concrete section, and a hydraulic section. The equipment is used by the Civil Engineering Department in connection with courses in Mechanics of Materials, Hydraulics, and Cement. Any student in the University who has the proper preparation may receive instruction in this laboratory.

The building is of modern steel frame construction, 94 feet wide and 115 feet long, with the main central section 65 feet in height, and two side sections of lesser height. The external walls which enclose the steel frame are of cement brick lined on the inside with red brick. A traveling crane, of 10-ton capacity, operated by electricity, commands the entire central portion of the building in which the testing of large specimens is carried on.

The general testing section is equipped with an 800,000-pound Riehle vertical screw testing machine, capable of testing columns 25 feet long or less, tensile specimens 20 feet long or less, and transverse specimens up to lengths of 30 feet; an Olsen universal testing machine of 300,000 pounds capacity; smaller machines for ordinary tension, compression, transverse, and torsion tests; a cold-bend testing machine, and a small machine shop. The hydraulic section occupies the east end of the main room and is equipped with various tanks, weirs, pumps, and other apparatus for studying problems in hydraulics. The cement and concrete section has a large room for the making and testing of specimens and a room for the storage of materials.

THE ECKLEY B. COXE MINING LABORATORY

The Eckley B. Coxe Mining Laboratory is a building of dressed sandstone 100 feet long by 75 feet deep, one story high in front with a raised floor in the rear.

The main part of the building contains the Ore Dressing Laboratory, 40 feet by 70 feet; the west wing contains a chemical laboratory, an assay room, a balance room, and a sampling laboratory; the east wing contains the office, a recitation room, and an instrument room. There is a locker and wash room in the basement of the east wing.

The equipment for the main laboratory, most of which was made by the Allis-Chalmers Co., consists of a gyratory crusher, rolls, screens, jigs, Huntingdon mill, classifiers, concentrators (tables and vanner), gravity stamps, amalgamating plates, grinding pan, with the necessary apparatus, including grizzly, elevators, feeders, sand-pumps, settling tanks, dryers, and electric motors. The sampling laboratory contains a small jaw crusher, a small gyratory crusher, rolls, sample grinder, and a magnetic separator.

The machinery is driven by seven separate motors, and any one part or all of it can be operated at will, permitting experimental studies and tests of individual machines or groups of machines, or of an entire process, as occasion may require. The entire plant is thus flexible and enables combinations of processes in order to determine the best method to pursue in the treatment of ores, by coarse and fine concentration, and also in the preparation of coals.

Owing to the prominence which flotation methods have assumed in ore concentration, a special department of the main laboratory has been equipped for this work, and several types of testing machines have been installed, together with the necessary equipment of motors, air compressors, etc., for their operation.

The laboratory houses also the following equipment: large and small size Ingersoll-Rand rock drills, Stoper and Jackhammer drills, an Ingersoll-Rand pick machine for coal mining, a Water-Leyner rock drill, a Sullivan hand-power diamond drill machine, and a Temple-Ingersoll electric-air drill.

The laboratory has been named by the Trustees of the University "The Eckley B. Coxe Mining Laboratory" in memory of Eckley B. Coxe, who was universally recognized as a pioneer and a leader in the profession of mining engineering in this country, an active friend and valued Trustee of the University from its early days until his death. The Engineering and Mining Laboratories of Lehigh University, bearing the names of John Fritz and Eckley B. Coxe, record the friendship and close association of these two great engineers in their life-time, and their active interest in Lehigh.

CHRISTMAS HALL

Christmas Hall has historic interest as the first building of Lehigh University. It was originally a church, which was purchased from the Moravian Congregation. In the earliest years of the University it contained a chapel, lecture rooms, and students' dormitory. After Packer Hall was completed in 1868, Christmas Hall and Saucon Hall were utilized as students' dormitories and mess hall up to 1885. For many years thereafter Christmas Hall was used by the Departments of Latin, Greek, and Modern Languages.

The building is now largely devoted to the Department of Military Science and Tactics.

The office and recitation room of the Department of Greek are on the second floor.

SAUCON HALL

Extensive alterations to Saucon Hall were made in 1896, adapting it to the needs of the Department of English. It contains a study and a recitation room for each instructor, a lecture hall seating 200 persons, and a large room on the ground floor which has been fitted up for the use of the literary societies, with committee rooms adjoining.

COPPEE HALL

Coppée Hall, formerly the Gymnasium, was completely renovated in 1913 to adapt it to the needs of the College of Arts and Science. On the first floor is a large lecture room, the office and recitation rooms of the Department of Econ-

omics, and accounting rooms for instruction in Business Administration. On the second floor are the offices and recitation rooms of the Departments of Latin, German, Romance Languages, and History. On the third floor is the seminar room of the College of Arts and Science, also a large room for the use of Accounting, and a Statistical Laboratory.

SAYRE OBSERVATORY

By the liberality of the late Robert H. Sayre, one of the Trustees of the University, an Astronomical Observatory was erected on the University grounds, and placed under the charge of the Professor of Mathematics and Astronomy.

The Observatory contains an equatorial telescope by Alvin Clark, of six inches clear aperture and of eight feet focus; a zenith telescope, by Blunt; a superior astronomical clock, by William Bond & Son; a meridian circle; a prismatic sextant, by Pistor and Martins; an engineer's transit and a sextant, by Buff and Buff. Students in practical astronomy receive instruction in the use of the instruments and in observation.

The land upon which the Observatory stands, consisting of seven acres adjoining the original grant, was presented to the University by the late Charles Brodhead, of Bethlehem.

Sayre Observatory Annex

Sayre Observatory Annex contains a modern zenith telescope of four and one-half inches clear aperture, equipped with electric illumination. The building and instruments were presented to the University by the late Robert H. Sayre in 1903. Observations secured with this instrument are for the purpose of investigating the Variations of Latitude.

THE PACKER MEMORIAL CHURCH

The Packer Memorial Church, in which daily chapel exercises are held, was the munificent gift of the late Mrs. Mary Packer Cummings, daughter of the founder of the University. It was built in 1887 and is one of the largest

churches in the State. During 1909-10 it was thoroughly renovated; the walls were newly frescoed, new stained glass windows put in place, and electric lights installed. These improvements were made possible by the continued generosity of the donor, Mrs. Cummings.

THE UNIVERSITY LIBRARY

The Library building was erected by the founder of the University in 1877, at a cost of \$100,000, as a memorial to his daughter, Mrs. Lucy Packer Linderman.

The building is semi-circular with a facade in the Venetian style of architecture. It is constructed of Potsdam sandstone with granite ornamentation. In the interior there is a reading room 40 by 50 feet, from which radiate bookcases extending from floor to ceiling; two galleries afford access to the upper cases. Shelf room is provided for one hundred and seventy thousand volumes. One hundred and sixty-four thousand volumes are now upon the shelves. The list of periodicals numbers about five hundred.

The Library is especially rich, for one of its size, in materials for research in history, American newspapers, and the history of early science, and in files of technical journals.

The Library is open from 8 a. m. to 9 p. m., except on Sundays and holidays.

Small working reference collections for laboratory use are maintained by the departments of Biology, Geology, Chemical, Civil, Mechanical and Mining Engineering.

The use of the Library, with privilege of taking out books, is offered to all members of the University—Faculty, students, and alumni. Students are allowed free access to the books and are encouraged to familiarize themselves with methods of using a library for literary and scientific work. The privileges of the Library are also extended to all qualified residents of the city. The Library hopes to be of service to the industries located in the community.

The Joseph W. Richards Library

The Joseph W. Richards Library of Metallurgy and Chemistry, consisting of about 3000 volumes, is located on the second floor of the William H. Chandler Chemical

Laboratory, and is open for use under the supervision of the Department of Metallurgy.

The Eckley B. Coxe Memorial Library

In memory of Eckley B. Coxe, who was for many years a Trustee of the University and who was profoundly interested in its welfare, Mrs. Coxe presented to the University his technical library, consisting of 7727 volumes, together with 3429 pamphlets. As the working library of a man who was remarkable as well for the breadth of his culture as for the extent and thoroughness of his acquaintance with the whole field of applied science, this addition to the resources of the University possesses the greatest value for all professional students.

TAYLOR HALL

Taylor Hall, the gift of Mr. Andrew Carnegie, is a commodious concrete dormitory situated in the University Park, south of Packer Hall. It accommodates 137 students. There are suites of three rooms (a study and two adjacent bedrooms), for two occupants, and a few single rooms. The building was named Taylor Hall by Mr. Carnegie in honor of Mr. Charles L. Taylor, his former partner in business, a graduate of the University in the Class of 1876 and a Trustee of the University. The rates for the suites of rooms are \$100 or \$120 a year for each occupant. The single rooms are \$50, \$65, or \$80 a year.

PRICE HALL

Price Hall furnishes dormitory accommodation for thirty-four students. It is named in honor of Dr. Henry R. Price, an alumnus of the University of the Class of 1870, late President of the Board of Trustees.

DROWN MEMORIAL HALL

Drown Memorial Hall is a memorial to the late Thomas Messenger Drown, LL.D., president of the University from 1895 to 1904. The building was erected by his friends and the alumni of the University and is devoted to the social interests of the University students. It contains study, reading, conversation, and chess rooms, an assembly hall,

and the offices of the Young Men's Christian Association, the college publications, and the dramatic and musical organizations.

LEHIGH ALUMNI MEMORIAL BUILDING

The Alumni Memorial Building, completed and occupied in the Fall of 1924, stands as a memorial to the more than 1800 Lehigh men who served in the World War, and especially in memory of the 46 who gave their lives. It cost to erect a half million dollars which was raised by subscription from about 1700 alumni. It is used as an administration building for the University. The Memorial Hall beneath the great tower will contain the records in bronze of the Lehigh men who served and those who died, together with certain mementoes of the War.

In the south wing of the building are the offices of the President of the University, the Vice-President and Comptroller, the Dean, the Registrar, and the Bursar, with their staffs. There is also a large faculty committee room in this wing and a kitchen and faculty dining room. The north wing contains the offices of the Alumni Association and of the Treasurer of the University, the students' supply bureau or university store, and the offices of the Lehigh Institute of Research, as well as a large room used for faculty meetings, receptions, dances, etc. This hall is also used for the annual meeting of the Alumni Association and meetings of the Alumni Council.

Not only was this building made possible by alumni gifts and built under their supervision, but the architects were Lehigh men, namely J. L. Burley, '94, and T. C. Vischer, '99.

TAYLOR GYMNASIUM AND FIELD HOUSE

In 1913, Mr. Charles L. Taylor, a graduate of the University of the Class of 1876 and a member of the Board of Trustees, donated to the University the funds required for the erection of a gymnasium and a field house.

Taylor Gymnasium is situated at the extreme east end of the grounds of the University, adjoining the athletic field. The building is 222 feet long by 73 feet wide. On the

ground floor at the north end is located the game room, 93 by 70 feet, used for basketball and wrestling. The game room is surrounded by a gallery for spectators. The main gymnasium floor measures 90 by 70 feet. Other rooms in Taylor Gymnasium are the offices and measuring room of the Department of Physical Education, a large trophy room, basketball and handball courts, fencing, boxing, and wrestling rooms, and locker rooms with accommodations for the entire student body.

The gymnasium is equipped with all modern appliances for recreative and corrective exercises, also with apparatus for calisthenics and other gymnastics, both for individual and for class work.

In addition to numerous hot and cold shower baths, adjoining the locker rooms is a swimming pool, 75 by 25 feet, with a depth from $4\frac{1}{2}$ to $9\frac{1}{2}$ feet. The capacity of the swimming pool is 95,000 gallons.

Adjoining the gymnasium and the stadium is the Taylor field house. It is two stories in height, and has dressing rooms, lockers, and shower baths for visiting and Lehigh teams, and also rooms for medical attention to athletes.

TAYLOR FIELD

An athletic field of more than nine acres in area is provided by the University for the accommodation of students who participate in the various outdoor sports. The Stadium is located on the north side, or lower level, and provides football and baseball fields. It is surrounded by concrete stands having a seating capacity for more than 12,000 spectators. On the upper level there are practice fields for football, baseball, lacrosse, and soccer; also a quarter mile track and a 220-yards straightaway, furnishing ample room for exercise by the entire student body. During the winter months a wooden outdoor running track, fourteen laps to the mile, is provided.

A cage with 60 by 120 feet floor space affords facilities for rifle practice, indoor baseball, lacrosse, and track and field sports practice.

SAYRE PARK

A development of the mountain side of the University grounds was effected through the donation to the University in 1909 of the sum of \$100,000 by the children of the late Robert H. Sayre to be applied and used in the development of Sayre Park as a memorial to their father. Mr. Sayre was a Trustee of the University from its foundation in 1866 to his death in 1907. He acted for years as President of the Board of Trustees, and as Chairman of the Executive Committee of the Board, and his services to Lehigh were constant and great.

THE ARBORETUM

The Arboretum is a tract of about eleven acres added in 1909 to the upper end of Sayre Park. It was established by a lover of Forestry and a friend of the University as a tree nursery for the purpose of furnishing illustrative specimens of American trees, and of cultivating trees and shrubs for the beautifying of the Park. All of the more important species of North American trees are to be found in the University Park and the Arboretum. Adjoining the Arboretum a tract of seven acres has been planted with a variety of indigenous trees as an exhibition growth of tree culture.

THE UNIVERSITY MUSEUMS

The University Museums include large collections illustrating various branches of Chemistry, Metallurgy, Geology, Mineralogy, Zoology, and Archaeology.

The Metallurgical Cabinet contains specimens illustrating the various processes for obtaining the more common metals.

The Zoological collections include the Packer collection of recent shells and the Werner collection of American birds. The latter contains over three hundred and fifty species. In most cases, in addition to the adults, specimens in different plumages as well as the nests and eggs are represented.

The Geological and Mineralogical Museums are housed in the west end of Williams Hall, and contain the Roepper and Keim mineral collections, collections of fossils, specimens of ore from mining districts, and extensive series of rocks which illustrate the type occurrences in different parts of the world.

The Cummings Archaeological Cabinet has three thousand specimens and includes Dr. Stubb's collection of Indian relics, weapons, and utensils.

TUITION AND OTHER FEES

Tuition, in all colleges of the University, per annum	\$300.00
Health Service Fee, per annum.....	10.00
Athletic Fee, per annum.....	10.00
Library Fee†	5.00

Total Annual Fees..... **\$325.00**

The above-mentioned fees are payable as follows:

FIRST TERM

(Payable on the Fall-Term Registration Days in September)

Three-fifths of the Annual Tuition.....	\$180.00
One-half the Annual Health Service Fee.....	5.00
The Athletic Fee, in full.....	10.00
One-half the Annual Library Fee.....	2.50

Total Fees, First Term **\$197.50**

SECOND TERM*

(Payable on the Spring-Term Registration Days in February)

Two-fifths of the Annual Tuition.....	\$120.00
One-half the Annual Health Service Fee.....	5.00
One-half the Annual Library Fee.....	2.50

Total Fees, Second Term **\$127.50**

* Students entering or re-entering in the second term pay first term fees, except that they pay only one-half the Athletic Fee (\$5.00).

† Not charged in the cases of students enrolled in the Summer Session, students in the Evening School of Business Administration, special students, or students registered for six term hours or less.

In addition, new students pay, once only, on admission, a Matriculation Fee of \$5, and students graduating pay a Graduation Fee of \$10.

There are also small laboratory fees or deposits in laboratory courses to cover the actual cost of laboratory supplies used by the individual student and to provide for breakage of glassware and instruments. The amounts of these fees and deposits are given in the Description of Courses in connection with each laboratory course.

Late Registration. The penalty for late registration is \$1.00 a day, up to a maximum of \$5.00, for each day of delay beyond the registration days in taking out the registration ticket; and a registration not completed within five days after the date on the registration ticket is subject to a late registration fee of \$5.00 a day.

No registrations will be accepted later than the tenth day of instruction.

Summer Session. For courses taken in the Summer Session, tuition is charged at the rate of \$10 per credit hour. For the summer of 1925 this fee will not be charged for courses regularly required as summer work in the various engineering curricula; but beginning with the summer of 1926, tuition will be charged for all summer work, including required courses.

To be eligible for a degree from Lehigh University, a student must not only have completed all of the scholastic requirements for the degree, but he must have paid all University fees and in addition, all bills for the rental of rooms in the dormitories, or for damage to University property or equipment, or for any other indebtedness to the University; it being understood, however that this regulation does not apply to any indebtedness for deferred tuition or for loans from trust funds administered by the University which are protected by properly executed notes approved by the Comptroller.

Refunds. A refund of one-half of the tuition of the current term, one-half of the athletic fee, and the unused balance of laboratory fees, will be made to students who

formally withdraw from the University within four weeks after the beginning of the term; a refund of three-quarters of the tuition, one-half of the athletic fee and the unused balance of laboratory fees will be made to students who formally withdraw within two weeks; a refund of the entire tuition, the entire athletic fee and the unused balance of laboratory fees, will be made to students who formally withdraw within one week. The matriculation fee, the health service fee, and the library fee will in no case be refunded. If a student is obliged to withdraw through injury or other physical disability and is unable to return later in that term, a pro-rata credit will be allowed toward the tuition of the corresponding term a year later.

EXPENSES

Necessary expenses for the collegiate year, clothing and traveling not included, are estimated at \$600 in addition to tuition.

The University dormitories accommodate 171 students. The charge for single rooms is \$50, \$65, or \$80 a year; suites of three or four rooms rent at \$100 or \$120 for each occupant. Numerous private householders in the city offer rooms and board at moderate prices.

Books, stationery, and drawing instruments may be purchased at low prices at the Students' Supply Bureau in the Alumni Memorial Building.

SCHOLARSHIPS, FELLOWSHIPS, AND PRIZES

UNIVERSITY SCHOLARSHIPS

The Trustees of Lehigh University have established the following scholarships, effective September 1, 1923:

I. Twenty-four scholarships (six in each of the four classes) which provide free tuition.

1. Three freshman scholarships to be awarded to the best of the candidates, each of whom must have presented evidence that he was in the highest 10% of his class in scholarship in the high school or preparatory school from which he was graduated.

2. Three freshman scholarships to be awarded to the best of the candidates, each of whom must have presented evidence that his average grade for the whole of his preparatory course was at least 10% above the passing grade of the school from which he was graduated and that he has shown superior ability in athletics.

3. Nine sophomore, junior, and senior scholarships (three in each class) to be awarded to the best of those students who, during the previous year at Lehigh University, were free from failures in their studies, and whose scholastic record placed them among the highest 20% of their class. Preference will be given to those students who have shown qualities of leadership.

4. Nine sophomore, junior, and senior scholarships (three in each class) to be awarded to the best of those students who, during the previous year at Lehigh University, attained average grades at least 10% above the passing grade and distinction in athletics.

II. Forty scholarships (ten in each of the four classes) which provide deferred payment of tuition.

1. Five freshman scholarships to be awarded to the best of the candidates, each of whom must have shown superior scholastic ability in the high school or preparatory school from which he was graduated.

2. Five freshman scholarships to be awarded to the best of the candidates, each of whom must have shown at least average scholastic ability and athletic skill in the high or preparatory school from which he was graduated.

3. Fifteen sophomore, junior, and senior scholarships (five in each class) to be awarded to the best of the candidates who, during the previous year at Lehigh University, have shown superior ability as students.

4. Fifteen sophomore, junior, and senior scholarships (five in each class) to be awarded to the best of the candidates who, during the previous year at Lehigh University, have shown at least average ability as students and superior ability as athletes.

The free and deferred tuition scholarships are awarded for one collegiate year only. Holders of scholarships may apply for a renewal of their scholarships for subsequent collegiate years.

Applicants for free or deferred tuition scholarships, must, in every case, present satisfactory evidence of their need of financial assistance. Each student to whom a deferred tuition scholarship is awarded must each term execute a note jointly with one of his parents or guardians or some other financially responsible person, payable five years from date, with interest at 6%.

These scholarships cover tuition only. Students are not permitted to defer the payment of laboratory, health service, athletic, or other University fees.

Applications for the foregoing scholarships will regularly be considered by the Committee on Scholarships and Loans on July first of each year.

Application blanks for these scholarships may be obtained by addressing the Committee on Scholarships and Loans, Lehigh University, Bethlehem, Pa.

THE WILBUR SCHOLARSHIP

The Wilbur Scholarship was founded in 1872 by the late E. P. Wilbur and provides the sum of \$200 awarded annually to the student in the Sophomore Class having the best record.

THE HENRY S. HAINES MEMORIAL SCHOLARSHIP

Mrs. Henry S. Haines, of Savannah, Ga., established in 1889 a scholarship of the annual value of \$200 as a memorial to her son, Henry Stevens Haines, M.E., a member of the Class of 1887. This scholarship is devoted to the support at Lehigh University, throughout his scholastic career, of one student in the Curriculum in Mechanical Engineering.

THE FRED. MERCUR MEMORIAL FUND SCHOLARSHIPS

Friends of the late Frederick Mercur, of Wilkes-Barre, Pa., General Manager of the Lehigh Valley Coal Company, desiring to establish a memorial of their friendship and esteem, and to perpetuate his memory, contributed and

placed in the hands of the Trustees a fund called "The Fred. Mercur Memorial Fund." The income from this Fund, amounting to \$600, is annually awarded to students of the University.

THE JOSEPH MANN PRICKITT SCHOLARSHIP

Mr. and Mrs. Cooper H. Prickitt, of Burlington, N. J., established, in April, 1919, a scholarship, to be known as the Joseph Mann Prickitt Scholarship, in memory of their son, Joseph Mann Prickitt, of the Class of 1917, who died on March 10, 1916.

This scholarship is of sufficient amount to cover expenses for tuition, fees, and books. It is the expressed wish of the donors that the scholarship be awarded to graduates of the Burlington, N. J., High School on the nomination of the Principal of that school, subject to the approval of the President of the University, or in case of no nomination from that school that the award be made to deserving students from other places.

THE ECKLEY B. COXE MEMORIAL FUND

In memory of the late Eckley B. Coxe, Trustee of the University, Mrs. Coxe has established a fund, amounting to \$64,350, the interest of which is used, under the direction of the Trustees of the University, and subject to such regulations as they may adopt, for the assistance of worthy students requiring financial aid.

THE FRANK WILLIAMS FUND

Frank Williams, E.M., of Johnstown, Pa., a graduate of the Curriculum in Mining and Metallurgy of the Class of 1887, who died in October, 1900, bequeathed to the University the greater part of his estate, now amounting to over \$140,000, to found a fund, the income of which is lent to deserving students. At present the larger part of this income is devoted to certain life tenants under Mr. Williams' will. After their death the entire income will be available for loans.

THE CALLENDER-CARNELL FELLOWSHIP

The Callender-Carnell Fellowship for the promotion of research in chemistry, established in 1919, is a gift of \$1500 annually by an anonymous friend of the late George D. Callender, a chemist, who died in Chicago in 1914 while associated with the donor of the scholarship, and of the late William C. Carnell. Mr. Callender was a native of Linlithgow, Scotland, and was graduated from the chemistry department of Glasgow University. Mr. Carnell was a graduate of the Curriculum in Chemistry of Lehigh University, of the Class of 1894.

NEW JERSEY ZINC COMPANY RESEARCH FELLOWSHIP

The New Jersey Zinc Company has provided funds for a research fellowship to be known as *The New Jersey Zinc Company Research Fellowship*, which is administered under the following regulations:

Appointment to this Fellowship will be for the period of two academic years, beginning September 1 and ending June 30, with an annual stipend of \$600 payable in ten installments, and freedom from University fees, except the matriculation fee of \$5 and the graduation fee of \$10. Half of the time of the holder of this Fellowship must be devoted to research work in the department to which he is assigned; the other half to graduate study leading to a Master's degree at the end of the two year appointment providing all University requirements for this degree have been satisfied.

Applications for appointment to The New Jersey Zinc Company Research Fellowship may be submitted by graduates in engineering or science of colleges, universities and technical schools whose requirements for graduation are substantially the same as those at Lehigh University. Applications should be sent to the President of Lehigh University, Bethlehem, Pa., on or before March 1. Each application for this Fellowship should be accompanied by a catalog of the institution from which the applicant graduated and a certificate of his college work, together with a statement concerning his practical experience and any other

evidence of his qualifications for the position which he may choose to submit. The applicant must indicate the line of graduate study he desires to undertake and his special qualifications for such work.

The holder of this Fellowship shall be required to devote approximately ninety hours per month independently of University holidays to research work assigned to him in the department to which he is attached; and he will not be permitted to accept any kind of employment for pay during either ten month period of his appointment.

THE WILBUR PRIZES

A fund was established by the late E. P. Wilbur for distribution in prizes as the Faculty shall determine. This fund yields an annual income of \$100.

THE PRICE PRIZE FOR ENGLISH COMPOSITION

Dr. Henry R. Price, an alumnus and Trustee of the University, established in 1898 an annual prize of the value of \$25, to be awarded in June to that member of the Freshman Class who shall write the best essay on a topic in English Literature assigned by the head of the Department of English not later than the beginning of the second term in each year. Special stress will be laid upon clearness of thought and force of expression. Students must signify in writing their intention of competing not later than the first of April.

THE JOHN B. CARSON PRIZE

An annual prize of \$50 was established in 1909 by Mrs. Helen C. Turner, of Philadelphia, Pa., in memory of her father, John B. Carson, whose son, James D. Carson, was a graduate of the Civil Engineering Department of Lehigh University in 1876. It is awarded for the best thesis in the Civil Engineering Department.

THE WILLIAM H. CHANDLER PRIZES IN CHEMISTRY

Four annual prizes in chemistry of \$25 each were established in 1920 by the gift of Mrs. Mary E. Chandler, of

Bethlehem, Pa., widow of Dr. William H. Chandler, who was Professor of Chemistry in Lehigh University from 1871 until his death in 1906. In memory of Dr. Chandler the Faculty named the prizes "The William H. Chandler Prizes in Chemistry." Awards are made at the commencement exercises in June to the four members of the freshman, sophomore, junior, and senior classes deemed by the Faculty worthy to receive them.

THE ELECTRICAL ENGINEERING PRIZE

An annual prize of \$25, established by an anonymous graduate of the Electrical Engineering Curriculum, is awarded to the member of the graduating class presenting the best thesis in Electrical Engineering.

ALUMNI PRIZES

By a resolution of the Alumni Association of September 21, 1900, the Alumni Scholarship Fund, which was originally designed to help poor students, was with the consent of the contributors diverted from this purpose and the income devoted to prizes to members of the Junior Class. In 1924 two prizes of \$25 each were awarded to the first honor men of the Curricula in Metallurgical and Mining Engineering. In subsequent years the prizes will be awarded to the first honor men of the technical curricula in turn.

THE ALUMNI PRIZES FOR ORATORY

The Alumni Association of Lehigh University established in 1882 annual prizes for excellence in oratory, amounting to \$50.

REGULATIONS

1. The contest shall be held on the 22nd day of February, or on the day designated by the University to commemorate the birth of Washington.
2. There shall be a first prize of \$25, a second prize of \$15, and a third prize of \$10.
3. To entitle one to be a competitor he must be a member of the Junior Class, taking a regular course.
4. Subjects for the orations shall be announced at the beginning of the first term of every year, and upon one of these each competitor shall write an oration not to exceed 1200 words, taking about eight minutes in delivery.

5. Each oration shall bear upon its first page a fictitious name or motto, and shall be accompanied by a sealed envelope, which shall be superscribed with the same name or motto, and an address by which it may be reclaimed. The envelope shall contain the real name and address of the writer, with the declaration that the oration is his own original work. The examiner, having adopted a standard of excellence, may reject any or all of the orations presented which do not attain to this standard; of such as do—should they be sufficient in number—the best six shall be chosen and their envelopes opened. The others shall be returned to the addresses given with their envelopes unopened.

6. The Executive Committee of the Alumni Association, or a committee of not fewer than three to be appointed by them, shall hear the competitors whose orations shall have been approved, and the awards shall be made by a majority of these judges.

7. In awarding the prizes the judges shall consider both the literary merits and the delivery of each oration.

8. These rules are subject to amendment by the Faculty.

THE WILLIAMS PRIZES IN ENGLISH

Professor Edward H. Williams, Jr., an alumnus of the University of the Class of 1875, established in February, 1900, prizes amounting annually to \$335 for excellence in English Composition and Oratory. The conditions of the endowment are as follows:

Sophomore Composition Prizes

1. At the beginning of each term the Sophomore Class shall be divided into two sections alphabetically and to that student in each section who, at the end of a term, and of each term, shall receive the highest rank in English Composition during that term shall be awarded the "First Sophomore Composition Prize" of ten dollars, and to that student in each section as aforesaid who shall receive the next highest rank in the same subject shall be awarded the "Second Sophomore Composition Prize" of five dollars. In each year there will be offered four first and four second prizes—a total of sixty dollars.

If more than one student shall receive the highest rank in any section, the amount of the two prizes shall be added together and the sum—fifteen dollars—shall be equally divided between them, and no second prize shall be offered in that section. If more than one student shall receive the next highest rank in any section when there is but one contestant for the first prize, the second prize shall be equally divided between the two having the second rank.

Senior Premiums

2. The Faculty shall publish within one month of the end of the University year a list of subjects for dissertations, selected from English Literature and Economics, entitled Subjects for Senior Premiums. To this list shall be appended a date near the first of January following—to be determined upon by the Faculty—when the contest shall be declared closed and the dissertations shall become due.

From the above list any member of the Senior Class may select a subject and write thereon a dissertation, the length of which shall be prescribed by the Faculty, and shall send the same anonymously, but marked for identification, as the Faculty may direct, to the Secretary of the Faculty before the date aforesaid.

The Faculty, or its committee, shall meet on the above date and at subsequent adjourned meetings, and, first, having determined upon a standard of excellence which each and all dissertations must reach in order to be admitted to the following competition, shall examine the dissertations submitted to them and admit those which reach the above standard. In case none is up to the standard and is admitted they shall declare the contest closed for that year, and no prizes shall be awarded.

If one or more dissertations are admitted as aforesaid, the Faculty, or its committee, shall arrange them in the order of their literary merit and the soundness of their reasoning, and the six highest in this arrangement shall be retained and all others returned as directed by the writers, who shall remain unknown. The names of the successful writers shall be ascertained, and they shall be required to recast their dissertations in the form of an oration, and to speak the same in public at such time during the Commencement Week as the Faculty shall determine.

The Faculty, or its committee, shall be the judges of excellence in the speaking, and shall award to that Senior student who shall speak his oration in the best manner, the Senior Gold Medal, of the value of one hundred dollars, or, at his option, one hundred dollars in gold. They shall award to the other five speakers the five Senior Premiums of ten dollars each.

Graduate Prize

3. At the end of the University year, during Commencement Week, the Faculty shall publish a second list of subjects for theses selected from English Literature, Economics, Mental and Moral Science, and similar subjects which require thought and application, and which must be of such a character that their mastery can be accomplished only through considerable research and study.

From this list any member of the class just graduating or of the Senior Class of the coming University year, any graduate of one year's standing whether in or out of residence, and any graduate of any class who may be, during the coming year, in actual residence and taking post-graduate work at the University, may select a subject and write thereon a thesis of not less than five thousand words and send the same to the Secretary of the Faculty, anonymously, but marked for identification as the Faculty may designate, before a date which the Faculty shall select within one month before the next Commencement, which date must appear on the above list.

The Faculty, or its committee, shall meet on this date, and at adjourned meetings thereafter, and, having first established a standard of excellence, which must, first, be a high one, and second, shall require on the part of the competitor ability in the plan, development, argument, and conclusion of the work, as well as literary merit in its composition and presentation, shall admit to the following competition only those who fully attain to the above required standard.

If none of the theses submitted shall have attained to the standard aforesaid, the competition shall be declared closed and the prize shall not be awarded.

To the author of that thesis which shall have been admitted to the competition, and which shall have been declared of the highest excellence, the Graduate Prize of one hundred and twenty-five dollars shall be awarded and presented on Commencement Day with the other prizes and awards of that day.

The successful thesis shall be the property of the University, but the author shall be allowed to retain one copy. Publication of the thesis by the author will only be permitted by vote of the Faculty. Such publication must, however, be entitled Graduate Prize Thesis of Lehigh University.

The winner of a prize shall not be allowed to compete again.

Professor Williams has directed that the income derived from the endowment for the Williams Prizes shall be applied and used as follows:

1. All portions of said income remaining after the payment of all prizes awarded in any one year shall be invested and added to the principal of the endowment.

2. If any prize shall, for any reason, be not awarded in any year, the sum thus unpaid shall be invested and added to the said principal.

3. If for any reason the amount of the income from said endowment shall fall below the total sum necessary to pay said prizes, the amounts of the individual prizes shall be proportionally reduced till their sum shall be equal to three-fourths of the said reduced income, and this three-fourths shall be used to pay them; the remaining one-fourth is to be invested and added to the said principal.

4. This investment of residues, as above said, shall continue till the principal of said endowment shall be sufficiently large to furnish an income at two per cent. interest, which will be sufficient to pay all said prizes now established.

5. When said principal shall be large enough to furnish the necessary sum to defray the said prizes, as stated in No. 4, the surplus income remaining after paying all the prizes awarded during the year shall be used by the President of the University to encourage oratory, debate, or any other object decided upon by the Faculty.

THE FRAZIER AND RINGER MEMORIAL FUND

This is a fund for the medical and surgical care of needy students, established in memory of Benjamin West Frazier, A.M., Sc.D., formerly Professor of Mineralogy and Metallurgy, and Severin Ringer, U.J.D., formerly Professor of Modern Languages and Literatures and of History, each of whom faithfully served Lehigh University for one-third of a century. The fund was started February 12, 1906, by

the donation of \$13,000 by the late Robert H. Sayre. It is the hope and expectation of the friends of the University that this fund may, by other donations, be increased in time to amount to a sum sufficient to insure free medical and surgical attendance to all students of the University requiring such aid.

THE AMERICAN BUREAU OF SHIPPING ANNUAL EDUCATIONAL PRIZES

The Board of Managers of the Bureau at their annual meeting held in January, 1924, voted to establish a system of cash prizes for scholarship at the various American institutions where the subjects of Naval Architecture and Marine Engineering are taught. The following rules have been adopted to govern the award of these prizes:

1. The prize shall consist of \$100.00 in gold.
2. A prize shall be given annually to the student qualifying at each of the following institutions:
 - a. Cornell University.
 - b. Lehigh University.
 - c. Massachusetts Institute of Technology.
 - d. University of California.
 - e. University of Michigan.
 - f. Webb Institute of Naval Architecture.Other institutions may be designated, when qualified under the terms of the award.
3. No award will be made to any student who is not an American citizen.
4. No award will be made to any student whose conduct and general standing is unsatisfactory.
5. As the early part of college courses is largely devoted to general education, the basis of the award shall be the highest average for the last two years of the course, in the regular prescribed subjects. Electives are not to be included in these averages.
6. Students who may come from other institutions and take the last two years of the courses in naval architecture and marine engineering may be considered as eligible for the award.
7. For the best interests of all concerned, holders of similar prizes or scholarships should not be considered as eligible.
8. The Faculty of the institution, or a committee of the main Faculty having jurisdiction over the courses involved, shall be the determining agency in selecting the student to whom the award is to be made, governed by the general rules herein set forth. Any minor questions in connection with the award shall be decided by the committee of each institution having charge.

9. It is requested that the student who is to receive the award shall be selected at least two weeks before the graduating day, and notification of the selection made is to be forwarded to the President, American Bureau of Shipping, 50 Broad Street, New York City, immediately after the selection is made.

10. The awarding of these cash prizes shall become effective for classes graduating in 1925, the award in each case to cover scholarship demonstrated in the two college years preceding.

GRADUATING THESES

Theses, when required, are accompanied by drawings and diagrams, whenever the subjects need such illustration. The originals are kept by the University, as a part of the student's record, for future reference, but copies may be retained by students, and may be published, permission being first obtained from the Faculty.

UNIVERSITY LECTURES

From time to time during the University year, distinguished men in science, letters, art, and business give lectures before the student body.

Sophomores and Juniors are required to attend these college lectures, and are given a total of one hour of credit toward graduation for attendance on three-fifths of the lectures given during the two years; *i.e.*, one-fourth credit hour per term. Students who fail to meet this requirement will be under the necessity of electing a substitute of the value of one credit hour. For seniors, attendance on the lectures is voluntary.

FRESHMAN ORIENTATION LECTURES

For freshmen a special series of talks, known as "orientation lectures," is provided. These are designed to assist the new men in adapting themselves to the new University environment and to suggest how they may make the most profitable use of their opportunities. Freshmen are required to attend both these orientation talks and the regular college lectures. For attendance at three-fifths of the total number of lectures in each term, one-half term hour of credit toward graduation is given; freshmen who fail to attend three-fifths of the required lectures must repeat the course the following year.

PLACEMENT SERVICE

The heads of the various technical curricula of the University cooperate with graduates in securing suitable professional openings.

Similarly, students who desire to teach are assisted in finding positions by the Faculty Committee on Teacher Placement. Such students are put in touch, also, with the Placement Service of the Teacher Bureau of the Department of Public Instruction of Pennsylvania at Harrisburg.

STUDENTS' HEALTH SERVICE

The Students' Health Service, organized in 1923, has general charge of all health and sanitary measures in the University. The work of the department is organized under four heads:

Sanitation

Physical Examinations

Dispensary Service

Education

Sanitation. The Director of the Health Service is in direct charge of the sanitation of University buildings and grounds, and exercises such supervision as is possible over other accommodations for students.

Physical Examinations. Each student is required to undergo a complete physical examination each year. This examination, which is made jointly by the Health Service and the Department of Physical Education, serves the needs of both these departments and also complies with the requirements of the Reserve Officers' Training Corps. All physical defects and departures from normal are noted, and the students are divided into groups as follows: (a) those who present no abnormalities and who can proceed with the regular mental and physical work of the University; (b) those who are abnormal or sub-normal, but who should be brought up to normal by the regular courses in Physical Education; (c) those who present physical conditions requiring special or corrective gymnastic work; (d) those who require other corrective measures.

Those students who fall into classes b, c, and d are observed at regular intervals, and every effort is made to bring them up to the highest degree of physical development and health. Individual records are kept of the progress of each case.

Dispensary Service. The Health Service maintains a dispensary in Saucon Hall where students may receive free treatment for minor illnesses and injuries. The Dispensary hours are from 8.30 to 12.00 a. m. on all week days, from 1.30 to 5.00 p. m. on week days except Saturday, and from 9.30 to 10.30 a. m. on Sunday. The Director of the Health Service is in his office at the Dispensary during stated hours when students can consult him. While the Health Service does not furnish medical attendance to students who are sick in their rooms, the Director keeps in touch with such cases by telephone and otherwise in so far as is possible in order to see that the students are receiving proper attention and that the time lost from University work is minimized. It is requested that all such cases, together with the names of the attending physicians, be reported to the Director in order that complete records of the health of the students may be kept.

Education. A series of lectures on Personal and Social Hygiene is given to freshmen by the Director of the Health Service in conjunction with the Departments of Biology and Physical Education. In these lectures emphasis is laid on those points of Personal Hygiene most applicable to the student recently deprived of the atmosphere and influences of home. In Social Hygiene an effort is made to disseminate correct information concerning the history and present status of social diseases and the effectiveness of approved methods for the relief of existing conditions. This phase of the Health Service constitutes a specific part of the general program of instruction recommended by the State Board of Health and by other recognized organizations for the promotion of social hygiene.

PUBLIC WORSHIP

Chapel exercises are held in Packer Memorial Church at 12 m. on every week day except Saturday. Attendance of freshmen and sophomores is required, of juniors and seniors voluntary.

THE UNIVERSITY Y. M. C. A.

The Christian Association is a voluntary organization of students for the promotion of the religious, moral, and social life of the University. It was organized April 18, 1890, and on October 11, 1890, united itself with the inter-collegiate Young Men's Christian Association. The movement is distinctly for and by students, all the officers, with the exception of the General Secretary, being chosen from the student body. The office of the General Secretary is in Drown Memorial Hall.

THE LEHIGH UNIVERSITY BAND

The University has a band, which is required to play at college activities and participate in military ceremonies when called upon by the Department of Military Science and Tactics. When participating in such ceremonies all members are required to wear military uniform, whether or not they are members of the Reserve Officers' Training Corps. These occasions occur once a week during the fall and spring and are of about twenty minutes' duration. Military uniforms, musical instruments, and music are furnished by the United States Government.

Students who elect band work and qualify for membership may substitute this work for their gymnasium classes and receive the same credit which they would normally receive from the Department of Physical Education. Those who are members of the Reserve Officers' Training Corps will also receive credit for one (1) hour of practical military drill a week.

In addition to the above credits, one (1) year of satisfactory service in the Band will entitle a student to a watch fob; two (2) years of service, a sweater; three (3) years, \$20.00 in cash; and four (4) years, an additional \$20.00 in cash.

These awards will be made only to those members of the Band who maintain at least sixty per cent. attendance each term at rehearsals, military ceremonies, and college activities.

HONORARY SCHOLARSHIP SOCIETIES

PHI BETA KAPPA. Students in the College of Arts and Science and the College of Business Administration who up to the middle of the senior year maintain high scholarship may be elected to membership; also a limited number of technical students whose work in philosophical, scientific, and language studies is of high grade.

TAU BETA PI. Students in the College of Engineering who up to the middle of the junior year maintain high scholarship may be elected to membership.

SOCIETIES OF THE COLLEGE OF ENGINEERING

An adjunct of value in promoting professional spirit in the College of Engineering is furnished by the departmental societies—voluntary organizations of students who meet monthly to present papers, to discuss engineering topics, and from time to time to hear addresses by invited engineers and scientists of note.

The first of these organizations historically was the Chemical Society, organized in 1871. The original Engineering Society, open to all technical students of the University, was started in 1872. From 1885 to 1889 it issued quarterly numbers of *The Journal of the Engineering Society of Lehigh University*, containing contributions by members, alumni, and others. Many of the papers read before this Society from 1890 to 1893 were published in the *Lehigh Quarterly* of those years.

Independent societies were formed in 1900 by students in the Departments of Civil Engineering and Mechanical Engineering. The Electrical Engineering Society, founded in 1887, was reorganized in 1901. The Mining and Geological Society began in 1904, the Metallurgical Society in 1917, and the Railroad Society and the Naval Engineering Society in 1920.

OTHER ORGANIZATIONS

Other student organizations include:

The Arcadia (student self-government body).

The Interfraternity Council.

The Beaux Arts Society (Arts and Science club).

Alpha Kappa Psi (honorary business fraternity).

Pi Delta Epsilon (honorary journalistic fraternity).

Robert W. Blake Society (honorary, philosophy, psychology, and education).

Scabbard and Blade (honorary military society).

Sword and Crescent (senior honorary society).

The Combined Musical Clubs.

Mustard and Cheese (dramatic).

Deutscher Verein.

Club Le Quinze (Romance languages).

The Radio Club.

Square and Compass (Masonic).

Saint Paul's Society (Episcopalian).

The following social fraternities have chapters at Lehigh University: Alpha Chi Rho, Alpha Tau Omega, Beta Theta Pi, Chi Phi, Chi Psi, Delta Phi, Delta Tau Delta, Delta Theta (local), Delta Upsilon, Kappa Alpha, Kappa Sigma, Phi Delta Theta, Phi Gamma Delta, Phi Sigma Kappa, Pi Lambda Phi, Psi Upsilon, Sigma Alpha Mu, Sigma Chi, Sigma Iota (local), Sigma Nu, Sigma Phi, Sigma Phi Epsilon, Theta Delta Chi, Theta Kappa Phi, Theta Xi.

STUDENT PUBLICATIONS

The students of Lehigh University publish a semi-weekly college newspaper, *The Brown and White*, a comic monthly, *The Lehigh Burr*, and a year-book, *The Epitome*.

FOUNDER'S DAY

The first Wednesday of October in each year is celebrated as Founder's Day in honor of the Founder of the University, the HONORABLE ASA PACKER. Degrees are conferred, and Freshman and Sophomore Honors and Prizes are announced.

The exercises of October 1, 1924, the forty-fifth Founder's Day, were devoted to the memory of Dr. Henry Reese Price, of the Class of 1870, late President of the Board of Trustees of the University. The principal address was "An Appreciation of the Life of Dr. Henry Reese Price," by Eugene Gifford Grace, E.E., Class of 1899, President of the Board of Trustees.

UNIVERSITY SUNDAY

The Sunday preceding University Day is known as University Sunday, and is devoted to the Baccalaureate Service. The Baccalaureate Sermon on June 8, 1924, was preached by the Rt. Rev. Charles Edward Woodcock, D.D., LL.D., Bishop of Kentucky.

UNIVERSITY DAY

University Day marks the close of the collegiate year. On this day the graduation exercises are held; an address is given by a representative of the Alumni Association, Senior Honors and Prizes are announced, and degrees are conferred.

The address at the exercises on June 10, 1924, was given by Augustus Parker-Smith, M.E., '84, LL.B., and was entitled "Forty Years as a Lehigh Alumnus."

THE ALUMNI ASSOCIATION

The Alumni Association, which has been in existence since 1876, was incorporated in 1917 under the name The Alumni Association of the Lehigh University, Inc. The Alumni Secretary is Walter R. Okeson, '96, and the Assistant Alumni Secretary is A. E. Buchanan, Jr., '18. Their offices are in the Alumni Memorial Building. They edit the *Lehigh Alumni Bulletin*, a news publication issued monthly from October to June, inclusive, and the *Alumni and Student List*. The Association is largely concerned with raising money to meet the needs of the University.

The officers of the Alumni Association for 1924-25 are:

President, C. A. Buck, '87, of Bethlehem, Pa.

Vice-President, E. H. Lawall, '82, of Wilkes-Barre, Pa.

Vice-President, R. H. Morris, '89, of Philadelphia, Pa.

Treasurer, J. Arthur Frick, '03, of Allentown, Pa.

Executive Secretary, Walter R. Okeson, '96, of Bethlehem, Pa.

Assistant Secretary and Treasurer, Andrew E. Buchanan, Jr., '18, of Bethlehem, Pa.

*Archivist, Preston A. Lambert, '83, of Bethlehem, Pa.

Honorary Alumni Trustees: Homer D. Williams, '87, of Pittsburgh, Pa.; Clarence W. Hudson, '89, of New York, N. Y.; Taylor Allderdice, '83, of Pittsburgh, Pa.; Aubrey Weymouth, '94, of New York, N. Y.; Alan C. Dodson, '00, of Bethlehem, Pa.; and Henry D. Wilson, '91, of Pittsburgh, Pa.

The following are the local alumni clubs: New York Lehigh Club, Philadelphia Lehigh Club, Pittsburgh Lehigh Club, Chicago Lehigh Club, Washington Lehigh Club, Detroit Lehigh Club, Northeastern Pennsylvania Lehigh Club (Scranton and Wilkes-Barre, Pa.), Maryland Lehigh Club (Baltimore, Md.), Lehigh Club of New England (Boston, Mass.), Intermountain Lehigh Club (Salt Lake City, Utah), Lehigh Club of Central Pennsylvania (Harrisburg, Pa.), Lehigh Club of Northern New York (Schenectady, N. Y.), Lehigh Club of Northern Ohio (Cleveland, O.), Lehigh Club of Southern New England (Hartford, Conn.), Lehigh Club of Western New York (Buffalo, N. Y.), Southern Anthracite Lehigh Club (Pottsville, Pa.), Lehigh Club of Arkansas (Little Rock, Ark.), Lehigh Home Club (Bethlehem, Pa.), Lehigh Club of China (Wuchang, China), Lehigh Club of Cuba (Havana, Cuba).

* Deceased, February 15, 1925.

HONORS AND PRIZES

Announced on University Day, June 10, 1924

Graduation Honors

GRADUATED WITH HIGH HONORS

HARRY ROSS GREER, Arts and Science, Atlanta, Ga.
CHARLES FRANCIS HILLER, Arts and Science, Buchanan, Mich.
JOHN C. KITCHEN, Chemical Engineering, Portland
WALTER CONRAD KLEIN, Arts and Science, Pottsville
LOUIS ALBERT LAUX, Mechanical Engineering, Baltimore, Md.
FREDERICK JOSEPH PEARSON, Arts and Science, Wilkes-Barre
BENJAMIN HARVEY REESE, Business Administration, Kingston

GRADUATED WITH HONORS

ERNEST WELLINGTON BAKER, Electrical Engineering, Harrisburg
MORRIS EARL BISHOP, Arts and Science, Bethlehem
PAUL SHAFFER BURT, Business Administration, Washington,
D. C.
LAYTON LAVERN CUPP, Mechanical Engineering, Williamsport
JAMES DI BIASE, Business Administration, Newark, N. J.
WILLIAM ROBERT DRAKE, Civil Engineering, Reading
ROBERT WILLIAM ENNIS, Civil Engineering, Mt. Penn
GEORGE LORENZO GRAMBS, Arts and Science, Scranton
JAMES STEWART GRIM, JR., Electrical Engineering, Kutztown
GEORGE HAMPTON, Chemical Engineering, Bridgeton, N. J.
ROBERT AUGUSTUS HECKERT, Arts and Science, Brackenridge
WALTER WILLIAM KEMMERER, Arts and Science, Wind Gap
GEORGE AUGUST LAUX, Mechanical Engineering, Baltimore, Md.
CHARLES BAYARD MITCHELL, Mining Engineering, Woodbury,
N. J.
THEODORE HORACE RAKESTRAW, Mining Engineering, Mechanics-
burg
JOHN MEALY ROBINSON, Mechanical Engineering, Pittsburgh
WALTER SCOTT THOMPSON, JR., Electrical Engineering, Sunbury
RALPH EDWARD UNDERWOOD, Arts and Science, Great Neck, L. I.
N. Y.
RUEL DEXTER WARRINER, Mining Engineering, Philadelphia
ARTHUR WOOD, Arts and Science, Providence, R. I.
WARREN WEBSTER YORK, Business Administration, Scranton

Prizes

JOHN B. CARSON PRIZE, \$50—for the best C. E. Thesis

JOSE MARIA CAROL, Cardenas, Cuba	} jointly
ROBERT WILLIAM ENNIS, Mt. Penn	

WILLIAM H. CHANDLER CHEMISTRY PRIZE, \$25—to the highest ranking senior in the curriculum

JOHN C. KITCHEN, Jr., Portland

ELECTRICAL ENGINEERING PRIZE, \$25—for the best E. E. Thesis

WALTER SCOTT THOMPSON, Jr., Sunbury

Freshman and Sophomore Honors (1923-4)

Announced on Founder's Day, October 1, 1924

(Awarded to those members of the Classes of 1927 and 1926 who made an average grade of B or higher during the scholastic year 1923-24)

FRESHMAN HONORS

FERNANDO CAPRILES AZPURUA, C.E., Puerto Cabella, Venezuela

RALPH WILLIAM BAKER, Ch. E., Roanoke, Va.

CHARLES WILLIAM BOWLER, M.E., Glenside

CHALLIS BRITTON, E.E., Scranton

LAMBERT EDWARD BROAD, B.A., Nazareth

CARLTON ERNEST BROWN, Ch.E., Washington, D. C.

RICHARD JAMES BUTZ, Ch.E., Allentown

RICHARD JOHN DEGRAY, Ch.E., Ramsey, N. J. ;

JOHN WALTER GISRIEL, Met., Baltimore, Md.

WILBUR EDWARD HARVEY, Met., Catasauqua

PERCY HUGH HEATON, Ch.E., Reading

JOHN ROWE HERTZLER, M.E., Lancaster

WEBSTER SOURBER JONES, B.A., St. Clair

EUGENE ALVIN KELLER, M.E., Takoma Park, D. C.

NORMAN LOUIS KREY, Ch.E., Washington, D. C.

BLAINE ALLEN MCCARTY, B.A., Pen Argyl

JOHN HENRY METZ, E.E., Scranton

JOSEPH ANTHONY NICHOLAS, E.E., Dunmore

CARL FRANK NORBECK, M.E., LaCrosse, Wis.

HENRY HAZEN SAMPSON, M.E., Westfield, N. J.

NORMAN SAMUEL SPATZ, E.E., Bernville

FREDERIC HARLAN WILHELM, Bus., Bethlehem

SOPHOMORE HONORS

DAVITT STRANHAN BELL, M.E., Pittsburgh
RUSSELL BERNHARD FLAMMER, Bus., Bethlehem
ROBERT EDGAR FREEMAN, Bus., Camden, N. J.
AUSTIN SHAFFER HALTEMAN, C.E., Allentown
JOSEPH GRAY JACKSON, Ch.E., Bala Cynwyd
FRANK GREGG KEAR, JR., E.E., Minersville
ROBERT CARL RICHARD MARSH, E.E., Philadelphia
DONALD McMILLAN MONG, E.E., Erie
HOWARD HEATH RAPP, B.A., Philadelphia
EDWIN RICHMAN, JR., E.E., Haddon Heights, N. J.
MILLARD ABRAHAM STOFFLET, B.A., Nazareth
EMERSON LEROY WALTERS, Bus., Bethlehem
BENJAMIN WEINSTEIN, B.A., Philadelphia

Prizes

WILBUR PRIZES, FRESHMAN YEAR

*Mathematics**First Prize, \$15*

RICHARD JOHN DEGRAY, Ch.E., Ramsey, N. J.

Second Prize, \$10

RICHARD JAMES BATZ, Ch.E., Allentown

English, \$15

CHALLIS BRITTON, E.E., Scranton

German, \$15

EARL HARTMAN SCHAUB, B.A., Freeland

French, \$15

WEBSTER SOURBER JONES, B.A., St. Clair

WILBUR PRIZES, SOPHOMORE YEAR

Mathematics, \$10

DONALD McMILLAN MONG, E.E., Erie

English, \$10

HOWARD HEATH RAPP, B.A., Philadelphia

Physics, \$10

DONALD McMILLAN MONG, E.E., Erie

WILLIAM H. CHANDLER CHEMISTRY PRIZES

Freshman Year, \$25

RICHARD JAMES BUTZ, Ch.E., Allentown

RICHARD JOHN DEGRAY, Ch.E., Ramsey, N. J.

} jointly

Sophomore Year, \$25

JOSEPH GRAY JACKSON, Ch.E., Bala Cynwyd

Junior Year, \$25

JAMES BLISS AUSTIN, Ch.E., Washington, D. C.

TAU BETA PI PRIZE (highest technical freshman)

JOHN HENRY METZ, E.E., Scranton

PRICE PRIZE IN FRESHMAN COMPOSITION, \$25

(No award)

ALUMNI PRIZES, JUNIOR YEAR

Metallurgy, \$25

MAURICE BERT LEVY, Met., Hazleton

Mining Engineering, \$25

RALPH ARTHUR LAMBERT, E.M., Bethlehem

WILBUR SCHOLARSHIP (for the best sophomore record),
\$200

DAVITT STRANHAN BELL, M.E., Pittsburgh (3.60)

HAINES SCHOLARSHIP (awarded on the recommendation
of the Department of Mechanical Engineering), \$500

CHARLES ELMER BARBA, JR., M.E. Newton, Mass.

DEGREES

Conferred on University Day, June 10, 1924

MASTER OF ARTS

WILLIAM LeROY FINK, A.B. (<i>Ursinus College</i>)	Slatington
HARVEY ALFRED ZINSZER, B.A. (<i>Lehigh University</i>)	Bethlehem

MASTER OF SCIENCE

RACHEL EVANS ANDERSON, B.A. (<i>Wellesley College</i>)	Easton
EUGENE WILLARD BURGESS, B.S. (<i>Lehigh University</i>)	Chicago, Ill.
PAUL NORMAN KISTLER, B.S. (<i>Pennsylvania State College</i>)	Bethlehem
WILLIAM ALFRED KRELDLER, B.S. (<i>Lehigh University</i>)	Bethlehem
LESTER LORRAINE LEACH, B.S. (<i>University of Missouri</i>)	Bethlehem
GEORGE AVERETT LYLE, B.S. (<i>Hampden-Sidney College</i>)	Bethlehem

BACHELOR OF ARTS

MORRIS EARL BISHOP	Bethlehem
HENRY ERNEST BONNEY	Pen Argyl
WILLIAM PAUL CANAVAN	Chester
ROBERT CHARLES DIETRICH	High Bridge, N. J.
RALPH WALDO EMERSON	Ridgefield Park, N. J.
CLAUD ANDREW FEGLEY	Bethlehem
ROBERT LOUIS FRANKE	Johnstown
BEVERLY STEWART GALLOWAY	Takoma Park, D. C.
ELISHA GEE, JR.	Denver, Col.
GEORGE LORENZO GRAMBS	Scranton
HARRY ROSS GREER	Atlanta, Ga.
ROBERT AUGUSTUS HECKERT	Breckenridge
GEORGE CONRAD HEIKES	Salt Lake City, Utah
CHARLES FRANCIS HILLER	Buchanan, Mich.
DAN PARMLLEE HOAGLAND, JR.	Bayonne, N. J.
WILLIAM HENRY HOMEYER	Jersey City, N. J.

GORDON TYRON JONES	Edwardsville
WALTER WILLIAM KEMMERER	Wind Gap
WILLIAM LEVI KICHLINE	Bethlehem
WALTER CONRAD KLEIN	Pottsville
JAMES PORTER LANGFITT	Parkersburg, W. Va.
JOSEPH ANTHONY MAGUIRE	Vineland, N. J.
ALFRED CRANE MCKENZIE	Brooklyn, N. Y.
PHILIP ROBERT MILLER	Bethlehem
FREDERICK JOSEPH PEARSON	Wilkes-Barre
MILTON SAMUEL ROTH	Butler
JAMES LEO SANFORD	Brooklyn, N. Y.
AUSTIN BARTHOLOMEW SAYRE	Glen Ridge, N. Y.
JOHN JOSEPH SHIGO, JR.	Hazleton
PAUL HERTZLER STERN	Elizabethtown
JOHN CASSEL SWARTLEY, JR.	Doylestown
WILLIAM HOWARD HOLLAND THOMAS	New Haven, Conn.
JOHN MITCHELL TUGGEY, JR.	Bethlehem
RALPH EDWARD UNDERWOOD	Great Neck, L. I., N. Y.
ARTHUR WOOD	Providence, R. I.

BACHELOR OF SCIENCE

ROBERT HOUSTON ALLAN	Jermyn
WILBUR GEORGE TRIPPLE BACHMAN	Allentown
GEORGE WARREN BOGGS	Melrose Park
JAMES ANDREW BOYD	Montvale, N. J.
PAUL SHAFFER BURT	Washington, D. C.
GEORGE EMIL WAGNER CORNELIUS	McKeesport
JAMES DiBIASE	Newark, N. J.
DONALD BENNER DICK	Hazleton
MAXWELL GLEN	Newbury, Mass.
CHARLES ALBERT HEIMBROOK	Bethlehem
ADRIAN MORELL MACKENZIE	Englewood, N. J.
ROBERT LESTER McINTIRE	Butler
JOHN RALPH MILLIGAN	East Liverpool, Ohio
MYRON TURNER MOORE	Youngstown, Ohio
ELDRIDGE EDWARD QUINLAN	Yonkers, N. Y.
BENJAMIN HARVEY REESE	Kingston
ARTHUR PARSONS ROBERTS	Englewood, N. J.

JOHN FREDERICK ROGERS
 PAUL ENGLEBERT SCHWARTZ
 WARREN WEBSTER YORK
 CHARLES EDWARD ZIEGENFUSS

Buffalo, N. Y.
 Harrisburg
 Scranton
 Bethlehem

CIVIL ENGINEER

JESSE ALBERT BUGBEE
 GEORGE WHITE CALLAHAN
 PAUL FREDERICK CAMPBELL
 JOSE MARIA CAROL
 ATTILIO PETER DIGIULIAN
 KENNETH DONALDSON
 WILLIAM ROBERT DRAKE
 ROBERT WILLIAM ENNIS
 HAROLD SIGMOND ERTNER
 HERMAN EUGENE KIEFER, JR.
 HARRY THEODORE LITKE
 EDWARD HARDY RICHARDSON
 JACK ELTON ROSS
 ELI HOWARD STRAWN
 ANDREW NEWTON WIEGNER
 BRUCE KUGLOW WINGATE

Trenton, N. J.
 Newport, R. I.
 Swedesboro, N. J.
 Cardenas, Cuba
 Washington, D. C.
 Washington, D. C.
 Reading
 Mt. Penn
 Camden, N. J.
 Miami, Fla.
 Millville, N. J.
 Malvern
 Newark, N. J.
 Quakertown
 Bethlehem
 Reading

MECHANICAL ENGINEER

LUTHER GERBER BOND
 THOMAS BENNEVILLE CRAIG
 LAYLON LAVERN CUPP
 WALTER MILLER DIENER
 HARRY DAVID GIHON, JR.
 CARROLL BREWSTER GRACE, JR.
 GEORGE WHITEFIELD HOPKINS
 LLOYD HORNPOSTEL
 GEORGE AUGUST LAUX
 LOUIS ALBERT LAUX
 ELBERT TYLER MAGRUDER
 JOSEPH ALOYSIUS MCBRIDE
 RUSSELL HENRY METZNER
 *M. WILLIAM NOLAN
 DONALD ADELBERT PARSONS

York
 Slatington
 Williamsport
 Hamburg
 Trenton, N. J.
 Philadelphia
 Cleveland, Ohio
 Pittsburgh
 Baltimore, Md.
 Baltimore, Md.
 Winchester, Va.
 Philadelphia
 Wheeling, W. Va.
 Washington, D. C.
 New Rochelle, N. Y.

* As of the Class of 1906.

LOUIS MOORE RICHARDS	Somerville, N. J.
HARRY GEORGE ROBINSON	Trenton, N. J.
JOHN MEALY ROBINSON	Pittsburgh
HENRY AUGUSTUS ROHRER	Lancaster
ERNEST ALLEN ROUCH	York
OLIVER HUBBARD SAUNDERS, JR.	Brooklyn, N. Y.
THOMAS CAMERON SMITH	Allentown
JAMES STANSBURY THAYER	Baltimore, Md.
ROBERT STANFORD WEBB	Asheville, N. C.

METALLURGICAL ENGINEER

EDMUND VANGILDER BENNETT	Lansdale
FRANK TAYLOR BUMBAUGH	Monessen
KUANG MING CHANG	Washington, D. C.
EDWARD PAUL HARTMAN	Bethlehem
STANLEY LEROY HAUSER	Kutztown
WALTER GOTTLIEB HESKE	Bethlehem
ALWIN JULIUS HOTTINGER	Kenvil, N. J.
JOHN JAY IVORY JAMIESON	Frackville
WILLOUGHBY JAMES LONG	Bethlehem
FLOYD HENRY WASSER	Bethlehem

ENGINEER OF MINES

EDGAR THOMAS ADAMS	Crafton
CONRAD FRIES CLOTHIER	Philadelphia
WILLIAM SCHAFF DAVIS, JR.	Lebanon
PAUL BUTLER FLECK	Pittsburgh
LOUIS DOSTER FOCHT	Trenton, N. J.
RICHARD ARTHUR HAWKINS	Forty Fort
FRANCIS LYNN HENDRICKSON	Woodbury, N. J.
RICHARD PAULMIER HOWELL	Bethlehem
GEORGE FRENCH JENKINS	Binghamton, N. Y.
†BYRON ALBERT CHAPMAN JOHNSTON	Tompkinsville, N. Y.
CHARLES BAYARD MITCHELL	Woodbury, N. J.
JOHN MARSHALL PIERSOL	Philadelphia
THEODORE HORACE RANESTRAW	Mechanicsburg
HENRY JOHN SCHRAUFF	Jersey City, N. J.
†JOHN STEGNER SIMMONS	Scranton
WALTER SIMEON SKEELS	Rochester, N. Y.
FRANCIS CARROLL STILLE	Woodbury, N. J.

† As of the Class of 1923.

STANLEY JOSEPH URBAN, JR.	Allentown
FREDERICK HENRY VILLAUME	New York, N. Y.
RUEL DEXTER WARRINER	Philadelphia
ELLIS LINCOLN WERFT	Altoona
WILLIAM POTTER WOOLRIDGE	Pittsburgh
TUNG YUAN	Peking, China

ELECTRICAL ENGINEER

CHARLES MAHIN ALFORD	East Orange, N. J.
CHARLES EMORY ALWINE	New Oxford
ERNEST WELLINGTON BAKER	Harrisburg
WILSON GORDON BOYDEN	Greenwich, Conn.
WARREN JAMES BRIDEGAM	Reading
JOHN FRANCIS FERRY	Allentown
CHARLES DAVID FARNEY	Hanover
PAUL LEROY GERHART	Reading
KENNETH WILLIAM GREEN	Weissport
JAMES STEWART GRIM, JR.	Kutztown
WALTER EARL KNOUSE	Washington, D. C.
DONALD CAMERON LUCE	Scranton
THOMAS MAXWELL	Baltimore, Md.
WILLIAM CHARLES MEYER	Bethlehem
JANVIER MAYHEW RICE	Bridgeton, N. J.
RALPH SHELLY RITTER	Quakertown
EDMUND LEWIS ROBINSON	Bethlehem
SIDNEY LINCOLN SATTENSTEIN	Reading
WALTER SCOTT THOMPSON, JR.	Sunbury
WILLIAM WEHRENBURG, JR.	Baltimore, Md.

CHEMICAL ENGINEER

JOSEPH BUDDINGTON DIETZ	Lancaster
EDWARD WERREY GORHAM	Brooklyn, N. Y.
GEORGE HAMPTON	Bridgeton, N. J.
JOHN C. KITCHEN	Portland
EDWARD THOMAS WARREN LORD	Philadelphia
HARRY AMMON MITMAN	Bethlehem
HENRY GORDON ROGERS	Newark, N. J.
FREDEBICK DEPPEN SNYDER	Harrisburg
EDWIN LEWIS STAUFFER	Northampton
*JAMES ARNOLD TODD	Doylestown
GRAHAM WENTZ	Scranton

MARINE ENGINEER

SIDNEY THOMPSON MACKENZIE
WALLACE MENGEL SCHLEICHER

Philadelphia
Maplewood, N. J.

NAVAL ENGINEER

JOHN PHILIP ZANNARAS

Bethlehem

MECHANICAL ENGINEER

As of the Class of 1878

HENRY MARISON BYLLESBY

Chicago, Ill.

COMMISSIONS AS SECOND LIEUTENANT IN THE
OFFICERS' RESERVE CORPS

CHARLES MAHIN ALFORD

Orange, N. J.

HENRY ERNEST BONNEY

Pen Argyl

FRANK LAWTON CHILDS

New York, N. Y.

LAYLON LAVERN CUPP

Williamsport

EDWARD WERREY GORHAM

Brooklyn, N. Y.

EDWARD ALLEN HAGENBUCH, JR.

Allentown

GEORGE HAMPTON

Bridgeton, N. J.

WILLOUGHBY JAMES LONG

Bethlehem

JOSEPH ANTHONY MAGUIRE

Vineland, N. J.

WILLIAM CHARLES MEYER

Bethlehem

LOUIS MOORE RICHARDS

Somerville, N. J.

EDMUND LEWIS ROBINSON

Bethlehem

JOHN MEALY ROBINSON

Pittsburgh

Conferred on Founder's Day, October 1, 1924

MASTER OF ARTS

HOBART AMORY FARBER, B.A.

Bethlehem

(Lehigh University)

MASTER OF SCIENCE

WALTER FLAMM QUAST, M.E.

Bethlehem

(Lehigh University)

BACHELOR OF ARTS

RICHARD JOSEPH BUCK

Bethlehem

ARTHUR WELLINGTON SPRINGSTEEN

Detroit, Mich.

CIVIL ENGINEER

WARREN NEWTON EDSON

Scranton

MECHANICAL ENGINEER

CHARLES JUSTIN ABEL	Elizabeth, N. J.
EARL HELMES JAMISON	Hazleton
KENNETH ELWELL QUIER	Bethlehem
JOHN HARRISON VANDYKE	Pittsburgh

ENGINEER OF MINES

PAUL WILSON REDLINE	Bethlehem
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ELECTRICAL ENGINEER

ALBERT NOVINGER SCHULTZ	Williamsport
-------------------------	--------------

CHEMICAL ENGINEER

*MEYER ISADORE GARBER	Norristown
WILLIAM SAMUEL MAJOR	Roebling, N. J.

MARINE ENGINEER

EDWARD HASKELL HEWSON	Havana, Cuba
RALPH JOSEPH KASPER	Ridgefield, Conn.

* As of the Class of 1923.

STUDENTS, 1924-5

GRADUATE STUDENTS

<i>Name</i>	<i>Candidate for</i>	<i>Residence</i>
Anderson, Harold Victor, B.Ch.E. (<i>University of Michigan</i>)	M.S.	Bethlehem
Billinger, Robert Dominick, Ch.E. (<i>Lehigh University</i>)	M.S.	Bethlehem
Bowman, Paul Emil, Ch.E. (<i>Lehigh University</i>)	M.S.	Bethlehem
Brown, Earl Haines, B.S. (<i>Pennsylvania State College</i>)	M.A.	Slatington
Carroll, Clara, B.A. (<i>Moravian College for Women</i>)	M.A.	Bethlehem
Castillejo-Convers, Gilbert, B.S., Ph.B.M.A. (<i>Colegio Superior, Bawanquilla, Columbia</i>) (<i>Universidad de Cochabamba, Bolivia</i>)		Bethlehem
Diamond, Harry B.S. (<i>Massachusetts Institute of Technology</i>)	M.S.	Bethlehem
Duck, Frank John George, B.S., Ch.E. (<i>St. John's College, Washington, D. C.</i>) (<i>Lehigh University</i>)	M.S.	Bethlehem
Ewing, Boyd Ross, Jr., B.A. (<i>Lehigh University</i>)	M.A.	Bethlehem
Fritsch, John Warren, B.A. (<i>Muhlenberg College</i>)	M.A.	Allentown
Greider, Emma Cora, B.A. (<i>Hunter College</i>)	M.S.	Stroudsburg
Hassler, Roy Diehm, B.S. (<i>Moravian College</i>)	M.A.	Bethlehem
Hibshman, Nelson Sherk, B.S. (<i>Pennsylvania State College</i>)	M.S.	Bethlehem
Kern, Nelson Eugene, Ph.B. (<i>Muhlenberg College</i>)	M.A.	Allentown
Knauss, Calvin Ambrose, B.S. (<i>Muhlenberg College</i>)	M.S.	Bethlehem

Lear, Gertrude Gugatsch, B.A. (<i>Cornell University</i>)	M.A.	Bethlehem
Liu, Min Chang, B.S. (<i>State College of Washington</i>)	M.S.	Bethlehem
Martin, Lydia Elizabeth, A.B. (<i>Moravian College for Women</i>)	M.A.	Northampton
Miller, Archie Roscoe, B.S. (<i>University of Illinois</i>)	M.S.	Bethlehem
Miyake, Masatoki, B.Eng. (<i>Waseda University</i>)	M.S.	Bethlehem
Old, Marcus Calvin, B.A. (<i>Lehigh University</i>)	M.A.	Bethlehem
Perkins, Wallace Wyman, A.B. (<i>Harvard University</i>)	M.A.	Bethlehem
Riley, John David, Jr., A.B. (<i>University of Pennsylvania</i>)	M.S.	Bethlehem
Schlenker, Roland Daniel, B.A. (<i>Albright College</i>)	M.A.	Slatington
Shelling, Hilda Naomi Hofford, B. A. (<i>Moravian College for Women</i>)	M.A.	Clarendon, Va.
Shunk, Helen Marian, A.B. (<i>Moravian College for Women</i>)	M.A.	Bethlehem
Smiley, Earl Kenneth, A.B. (<i>Bowdoin College</i>)	M.A.	Bethlehem
Smith, Norman Elwood, A.B. (<i>Pennsylvania State College</i>)	M.A.	Slatington
Snyder, James Wilson, A.B., M.A. (<i>Bucknell University</i>)	M.A.	Slatington
Solt, Marvin Reinhard, B.S. (<i>Lehigh University</i>)	M.A.	Bethlehem
Somerville, John Howard, B.S. (<i>Schuylkill University</i>)	M.S.	Bethlehem
Strunk, Elvira M., B.S. (<i>Albright College</i>)	M.S.	Allentown
Stump, Wayne G.	M.A.	Allentown

Taylor, Robert Norman, Ph.B., B.S. (<i>Muhlenberg College</i>)	M.A.	Hellertown
Thomas, George Edward, Ph.B. (<i>Muhlenberg College</i>)	M.A.	Allentown
Thompson, Richard Nelson, A.B. (<i>Cornell University</i>)	M.A.	Bethlehem
Tolpin, Jacob (<i>University of Kiev</i>) (<i>University of Jena</i>)	M.S.	Bethlehem
Transue, William John, B.S. (<i>Moravian College</i>)	M.A.	Catasauqua
Wentz, Graham, Ch.E. (<i>Lehigh University</i>)	M.S.	Bethlehem
Williams, Robert Everett, A.B. (<i>Lafayette College</i>)	M.A.	Easton
Wilson, Genevieve, A.B. (<i>University of Pennsylvania</i>)	M.A.	Bethlehem
Winfree, William Wilbur, B.S. (<i>Virginia Polytechnic Institute</i>)	M.S.	Lynchburg, Va.
Zinszer, Harvey Alfred, B.A. (<i>Lehigh University</i>)	M.S.	Bethlehem

UNDERGRADUATES

B.A.—Arts and Science	E.M.—Mining Engineering
Bus.—Business Administration	E.Ph.—Engineering Physics
C.E.—Civil Engineering	Mar.E.—Marine Engineering
Ch.E.—Chemical Engineering	M.E.—Mechanical Engineering
Chem.—Chemistry	Met.—Metallurgy
E.E.—Electrical Engineering	

SENIOR CLASS

Class of 1925

<i>Name</i>	<i>Curriculum</i>	<i>Residence</i>
Adams, Robert Burnette	Bus.	Brockton, Mass.
Akialis, Joseph Michael	Ch.E.	Newark, N. J.
Allen, Charles Wesley	E.M.	Reading
Allen, Walter Rue	E.E.	East Orange, N. J.
Astarita, Francis Sandford	Bus.	New York, N. Y.
Austin, James Bliss	Ch.E.	Washington, D. C.
Ayers, William DeWitt	C.E.	Branchville, N. J.
Ayres, Clarence Cornelius	E.E.	Chester
Barton, Frederic Charles, Jr.	Bus.	Tenafly, N. J.
Batz, Kenneth William Yates	M.E.	Staten Island, N. Y.
Bayles, Allison Lerch	M.E.	Charleston, S. C.
Beck, Frederick Charles	E.E.	Philadelphia
Beggs, Charles Wendell	Ch.E.	Wilkinsburg
Behr, William John, Jr.	Mar.E.	Montclair, N. J.
Berg, Frederick Christian	Mar.E.	Philadelphia
Berger, Francis Joseph	E.E.	Wilkes-Barre
Bevan, James Elmer	E.E.	Frackville
Bidwell, James Truman	B.A.	Portland, Ore.
Binkley, Edward Lehman	E.E.	Hagerstown, Md.
Blake, Alfred Greene	C.E.	Pittsburgh
Bokum, William Harold	E.E.	Philadelphia
Bond, Louis Boutell	M.E.	Philadelphia
Borda, Russell Berger	Bus.	Schuylkill Haven
Borden, Robert Oswald	M.E.	Front Royal, Va.
Bowman, John Gheen	C.E.	Lansdale
Britt, Therman Paul	Bus.	Rydal
Brooks, Charles Emery	M.E.	Glen Ridge, N. J.

Brown, Ernest Embich	E.E.	Lebanon
Brown, Merritt Weaver	B.A.	Bethlehem
Brunstein, Maurice	Ch.E.	Atlantic City, N. J.
Buerman, Arthur William	C.E.	Newark, N. J.
Bunn, George William	B.A.	East Stroudsburg
Burke, Edmund Michael	C.E.	West Pittston
Burns, William Ryan	C.E.	Port Chester, N. Y.
Burton, John Taylor	C.E.	Chestnut Hill
Campbell, Andrew Hiester	C.E.	Pottstown
Carter, William Campbell	Chem.	Phoenixville
Castleman, Francis Lee, Jr.	B.A., C.E.	Philadelphia
Chambers, Harold Bair	Met.	Lancaster
Cheel, Robert Duncan	M.E.	Ridgewood, N. J.
Cohen, Milford Hersh	Ch.E.	Charleston, W. Va.
Colclough, William Frederick, Jr.	B.A.	Catasauqua
Cook, Nevin John	B.A.	Drums
Coopersmith, Charles	C.E.	Philadelphia
Cornelius, Charles Taylor	M.E.	Pittsburgh
Cottman, Llewelly Powell	B.A.	Baltimore, Md.
Coulton, John Marshall	C.E.	Red Bank, N. J.
Croll, John Harold	E.M.	Steelton
Cumming, Benjamin Wilson	Bus.	Pottsville
Davis, James Hornor	B.A.	Clarksburg, W. Va.
Davis, Richard Light	E.M.	Lebanon
Day, Hugh Taylor	B.A.	Philadelphia
Dietrich, Horace Wilcox	C.E.	Baltimore, Md.
Dinkey, Charles Eugene, Jr.	E.M.	Pittsburgh
Dithridge, Edward Hay	Ch.E.	Morrisville
Dorton, Frederick Babcock	B.A.	Baltimore, Md.
Drury, William George	C.E.	West Pittston
DuBois, Allen Corson	B.A.	Clayton, N. J.
Dudley, Thomas Underwood	Ch.E.	Middleburg, Va.
Dykes, Henri Victor dePuis	B.A.	Bethlehem
Egolf, Harry Louis, Jr.	E.M.	Philadelphia
Emanuel, Robert Samuel	M.E.	Nesquehoning
Entrekin, Jaul Brinton	E.M.	Swarthmore
Everhart, John Lawrence	Ch.E.	Bethlehem
Ewart, Roswell Horr	Ch.E.	Plainfield, N. J.
Feick, Rufus Daniel	Ch.E.	Kutztown
Finegan, Paul James	B.A.	Burlington, N. J.
Fister, Lee Harold	E.E.	Reading

Flory, Curtis Bertram	Bus.	East Orange, N. J.
Frey, Frank Gustave, Jr.	M.E.	Baltimore, Md.
Fritzsche, Otto Herbert Adolph	C.E.	Irvington, N. J.
Fullard, William George	B.A.	New York, N. Y.
Gairns, William Otto	Ch.E.	LaGrange, Ill.
Gallagher, Charles Barto	B.A.	Asbury Park, N. J.
Garra, Edward Joseph	B.A.	White Haven
Geho, Charles Henry	Ch.E.	Allentown
Gibson, Kenneth Durward	Bus.	Belleville, N. J.
Gondos, Robert Zoltan	Ch.E.	Reading
Gorgas, Charles Crawford	Bus.	Paterson, N. J.
Green, Thomas Edgar	Bus.	Butler
Greene, Henry Eckford, Jr.	Bus.	Amsterdam, N. Y.
Greer, William Chamberlain	Bus.	Woodbury, N. J.
Groner, Stephen Sheldon	Bus.	Syracuse, N. Y.
Gruhn, Arthur Max	Bus.	Brooklyn, N. Y.
Gyourko, Joseph Edward	M.E.	Eckley
Hagenbuch, Edward Allen, Jr.	E.E.	Allentown
Harris, Abraham Buckley	Ch.E.	Baltimore, Md.
Hay, Erroll Baldwin, Jr.	M.E.	Philadelphia
Hoffman, William Jacob	B.A.	Raubsville
Holzshu, Charles David	E.E.	Cumberland, Md.
Horn, Franklin Leferer	Bus.	Allentown
Howland, George Asbury	Ch.E.	Asbury Park, N. J.
Hunter, Francis Alexander	M.E.	Hoboken, N. J.
Hursh, James Sharpe	B.A.	Newville
Hutchinson, Stuart Buckler	C.E.	Bethlehem
Ingols, Heber Ashe	Ch.E.	Newark, N. J.
Isaacs, Kenneth Lothaire	M.E.	Scranton
Jones, Edwin Pitchford	Bus.	Valencia
Keating, Miles James	Bus.	Bethlehem
Keim, John Kenneth	M.E.	Bethlehem
Keller, Edwin Walker	B.A.	Allentown
Keller, Francis Randolph	E.E.	Allentown
Kerr, Harry Knight	Ch.E.	Philadelphia
King, Arthur Stanley	M.E.	Toms River, N. J.
Kingham, Lawrence Brewster	Bus.	East Orange, N. J.
Kirchner, Earl Lorenz	Ch.E.	Washington, D. C.
Kittinger, Spencer Colie	Bus.	Buffalo, N. Y.
Koegler, George Franz	B.A.	New York, N. Y.
Krazinski, Leo Charles	E.E.	Mahanoy City

Lambert, Ralph Arthur	E.M.	Bethlehem
Lang, Elheim	Ch.E.	Phoenixville
Langfitt, James Porter	B.A., M.E.	Parkersburg, W. Va.
Laramy, William John	E.M.	Altoona
Lawall, Paul	E.M.	Catasauqua
Leavens, William Barry, Jr.	E.E.	Maplewood, N. J.
Lee, Russell Werner	Ch.E.	Ottawa, Ill.
Leib, James Fulton	Bus.	Baltimore, Md.
Lerch, Franklin Stuart	B.A.	Freemansburg
Leshefka, George John	E.Ph.	McAdoo
Levin, Nathan	M.E.	Trenton, N. J.
Levitz, Max	Bus.	New York, N. Y.
Levy, Maurice Bert	Met.	Hazleton
Lewis, Robert	Bus.	New York, N. Y.
Light, Berlin Carl	Ch.E.	Reading
Lingle, Charles Fitting	Bus.	Harrisburg
Ludwig, Edward Henry	Ch.E.	Staten Island, N. Y.
Lundberg, George Otto	M.E.	Lansing, Mich.
MacFate, Robert Preston	Ch.E.	Bethlehem
McFadden, Hugh Paul	B.A.	Bethlehem
McKee, John Edwin	Ch.E.	Newport
McMorris, William Barnhart	C.E.	Harrisburg
Mandell, Leon Nathaniel	Ch.E.	Philadelphia
Martin, Frederic Thurman	Ch.E.	Harrisburg
Master, Warren	E.E.	Reading
Mattern, Robert Jones, Jr.	Bus.	Collingswood, N.J.
Matthews, Armstrong Robertson	E.M.	Nashville, Tenn.
Mayberry, Harold	Bus.	Mahanoy City
Mell, William Harvey	C.E.	Roanoke, Mo.
Metten, William Murray	Bus.	Wilmington, Del.
Miller, Howard Frederick	M.E.	Easton
Miller, Raymond Hall	B.A.	Salem, N. J.
Miller, William Hurxthal	E.E.	Glendale, Ohio
Minster, Pemberton Foster	Bus.	Bristol
Moran, Eugene Francis, Jr.	Mar.E.	Brooklyn, N. Y.
Morgan, William John	Bus.	Bethlehem
Moritz, George Robert	Met.	Allentown
Myers, John Alfred	M.E.	York
Neely, Rodgers	B.A.	Ben Avon
Nehemiah, Maurice Albert	Bus.	Brooklyn, N. Y.

Nicola, Oliver Peter, Jr.	E.M.	Pittsburgh
Noerr, Robert Collyer, Jr.	Ch.E.	Hartford, Conn.
O'Neill, Joseph James	B.A.	Montclair, N. J.
Orr, Earl Haas	Met.	Lansdale
Palmer, Arthur Carl	C.E.	New York, N. Y.
Palmer, Herbert William	B.A.	Pen Argyl
Parker, Norman Douglass	E.E.	Washington, D. C.
Patty, Claibourne Watkins	E.M.	Little Rock, Ark.
Paxton, George Benjamin	M.E.	Harrisburg
Pfaffhausen, Herbert Lee	M.E.	Union Hill, N. J.
Pharo, Homer Durand	Ch.E.	Cranford, N. J.
Phillips, Harry Kenneth	Bus.	Glen Ridge, N. J.
Pilat, William J.	B.A.	New York, N. Y.
Pineda, Luis Guillermo	E.E.	Venezuela, S. A.
Pittenger, Harry Joseph	E.M.	Bethlehem
Polatchek, Jerome Julius	E.M.	New York, N. Y.
Porter, Clarence Henry	M.E.	Washington, D. C.
Purdy, Victor Moreau	Met.	Brooklyn, N. Y.
Rankin, Bryant Loose	Met.	Reading.
Ransom, James Dudley	Ch.E.	Jersey City, N. J.
Ratajczak, Frank Xavier	E.E.	Reading
Reid, William Alexander	M.E.	Glen Ridge, N. J.
Reyer, William Aaron	Chem.	Northampton
Rhoades, Ronald Sage	E.M.	Nutley, N. J.
Rice, Charles Lewis	C.E.	Hazleton
Rice, Mark Samuel	Bus.	Bethlehem
Rice, Robert MacLean	E.E.	Reading
Roberts, Carlton Mitchell	C.E.	Asbury Park, N. J.
Roberts, Paul Eagon	B.A., E.M.	Parkersburg, W. Va.
Rorabaugh, Merrill Schaeffer	E.E.	New Kensington
Ross, Rodney Wyckoff	Bus.	Asbury Park, N. J.
Rostow, Lawrence	Ch.E.	Newark, N. J.
Ryan, Michael Joseph	B.A.	Bethlehem
Samuels, Fred Herman	B.A.	Newark, N. J.
Saxtan, Eugene Harris	Bus.	Jersey City, N. J.
Schock, Harvey Harold	Ch.E.	Shartlesville
Seeley, Robert Inglis	C.E.	Keansburg, N. J.
Senior, Palmer Newman	E.M.	Bridgeport, Conn.
Shoemaker, Howard Edward Walter	C.E.	Freeland

Sholes, Charles Latham	Bus.	Short Hills, N. J.
Siegmund, Harry Loew	Ch.E.	Harisburg
Smith, Morris Sparhawk	M.E.	Swarthmore
Smith, Walter Reynolds	B.A.	Carbondale
Springsteen, William	Bus.	Detroit, Mich.
Stahl, Harry Ernest, Jr.	B.A.	Trenton, N. J.
Stazinski, Peter Felix	M.E.	Plymouth
Stelle, Kenneth Lawrence	Bus.	Jamaica Plain, Mass.
Stott, Frank Janney	Bus.	Philadelphia
Su, Harry Fang Piu	E.M.	Amoy, China
Swartz, Ralph Christian	M.E.	Allentown
Taylor, Robert Sayre, Jr.	B.A.	Bethlehem
Taylor, Thomas Frederic	C.E.	Casson
Thomas, Hopkin Buckland	M.E.	Catasauqua
Troland, Hugh Moore, Jr.	C.E.	Philadelphia
Troutman, Roy Ezra Holzman	Ch.E.	Bethlehem
Trumbore, Clarke Richard	B.A.	Bethlehem
Trumbore, Frederick William	B.A.	Bethlehem
Trushel, William Carl	B.A.	Warren
Tyler, Walter Simeon, Jr.	Ch.E.	Bridgeport, Conn.
Unkles, John Jacob	Bus.	East Orange, N. J.
VanNostrand, Erwin Skidmore	M.E.	Toms River, N. J.
Verlenden, John Boyd	C.E.	Darby
Volkmar, Karl	C.E.	Williamsport
Walker, Joseph Beidler	M.E.	Norristown
Walker, William Higham	E.M.	Riverside, N. J.
Wallace, Kenneth Campbell	Ch.E.	Bridgeport, Conn.
Walters, Frank Clayton	Mar.E., B.A.	Bethlehem
Waltman, John Richard	E.M.	Bethlehem
Wardell, Weston Burnet	Bus.	East Orange, N. J.
Washburn, Lindsley Morgan	Bus.	Wilkes-Barre
Weissenborn, Albert Edward	E.M.	Montclair, N. J.
Welch, Heister Jacob	Mar.E.	Elmira, N. Y.
Weston, Thomas Carroll	M.E.	Philadelphia
Wetterau, Paul Christian	Ch.E.	Hazleton
Wolcott, Leslie Carl	E.E.	Warren, Ohio
Woodrow, Maurice O.	C.E.	Wilkes-Barre
Wurster, Luther Conrad	E.E.	Harrisburg

JUNIOR CLASS

Class of 1926

<i>Name</i>	<i>Curriculum</i>	<i>Residence</i>
Abel, David Heaton	B.A.	Ogontz
Allard, Charles Norman	E.M.	Wildwood, N. J.
Althouse, Ernest Emmanuel	E.E.	Hamburg
Ambler, Charles Merrill	Bus.	Abington
Anderson, Paul Sutro	Bus.	Westfield, N. J.
Applegate, William McLean	E.E.	Red Bank, N. J.
Bachman, George, Jr.	C.E.	Camden, N. J.
Bachman, Joseph Peter, Jr.	Bus.	Allentown
Barnes, John Francis	E.M.	Bethlehem
Bayard, Arnold Aaron	M.E.	Philadelphia
Bell, Davitt Stranhan	M.E.	Pittsburgh
deBenneville, George Inami	Chem.	Philadelphia
Best, Ralph Walter	E.E.	Allentown
Bigley, James Warren	E.E.	Kingston
Binai, Rong	Ch.E.	Washington, D.C.
Bishop, Bruce Hunter	M.E.	Scranton
Bishop, Morris Earl	Ch.E.	Bethlehem
Bissinger, John Abraham	M.E.	Harrisburg
Bogart, Louis	Bus.	New York, N. Y.
Bond, Nelson Leighton	Bus.	Montclair, N. J.
Borneman, Walter Houck	E.E.	Millville, N. J.
Boush, Gilbert Wesley	E.M.	Elizabethtown
Bridge, Ernest Laithwaite	B.A.	Glen Ridge, N. J.
Brinser, Donald Christian	B.A.	Harrisburg
Broome, Ross Alexander	Bus.	Scranton
Brown, LeRoy Augustus	M.E.	Allentown
Brown, Willard Marshall	Ch.E.	Palmerton
Buell, David Clinton, Jr.	E.M.	Middletown, N. Y.
Buenning, Carl Anthony	E.E.	Easton
Burgess, Henry Russell	C.E.	Pittsburgh
Bushar, Harold Gordon	C.E.	Pottsville
Callow, Michael John	Met.	New York, N. Y.
Canfield, Donald	Bus.	Caldwell, N. J.
Carter, Norman Campbell	Chem.	Phoenixville
Case, Rowland Bertram	M.E.	Phillipsburg, N. J.
Cetina, Renan	E.E.	Frontera, Tabasco, Mexico

Chew, Edmund Freeman	M.E.	Woodbury, N. J.
Childs, Frank Lawton	Bus.	New York, N. Y.
Cimbala, Joseph Albert	E.E.	Milnesville
Corson, Osman Myron	E.E.	Cape May Court House, N. J.
Cottman, William Watson, Jr.	M.E.	New Hope
Couch, Leonard Huguenor	Bus.	Eden, N. Y.
Cowan, Theodore Mayham	B.A.	Glen Cove, N. Y.
Craig, John Horner	Ch.E.	Slatington
Cressman, Paul Kreidler	B.A.	Bethlehem
Cryder, William Adam	Bus.	Berwick
Curtis, Edward Aloysius	Bus.	Lambertville, N. J.
Cyphers, Kenneth Alexander	M.E.	Bethlehem
Davis, Clyde	Bus.	Pittsburgh
DePuy, Stuart Walton	Ch.E.	Hammonton, N. J.
DeWitt, William Carpenter, Jr.	M.E.	Phillipsburg, N. J.
Douglas, Norman Engleman	Chem.	Baden
Dunn, Robert Clarence	Bus.	Park Ridge, N. J.
Dutt, Louis Merritt	B.A.	Bangor
Dwyer, William Joseph	Bus.	Bethlehem
Dyson, Robert Harris	E.E.	Washington, D. C.
Eagleton, Sterling Paul	M.E.	Salem, Ohio.
Earle, John Goldsborough	Mar.E.	Easton, Md.
Elliott, Lewis Charles, Jr.	C.E.	York
Elmer, Robert William	E.Ph.	Bridgeton, N. J.
Evans, Merle Albert	E.M.	Ebensburg
Faga, Edgar Monroe	Bus.	Bethlehem
Flammer, Russell Bernhard	Bus.	Bethlehem
Foster, Arthur	E.E.	Big Stone Gap, Va.
Fouchaux, Julien Ellis	E.E.	Paterson, N. J.
Fraivillig, Leonard Martin	C.E.	Bethlehem
Freeman, Robert Edgar	Bus.	Moorestown, N. J.
Fulton,, Arthur Logan	B.A.	Catasauqua
Garbarino, Stephen Lawrence	Bus.	Shenandoah
Giles, Edward Maynard	Ch.E.	Paterson, N. J.
Glenn, Graeff William	M.E.	Elkins Park
Godshalk, Gerald Desmond	E.M.	Lansdale
Gordon, Malcolm Kenneth, Jr.	E.Ph.	New York, N. Y.
Grieb, Conrad Keital	E.E.	Baltimore, Md.
Griesemer, David Elias	M.E.	Allentown

Haefeker, George Augustus	B.A.	Tamaqua
Halteman, Austin Shaffer	C.E.	Allentown
Harmon, Herbert Greason	E.M.	Ridgewood, N. J.
Harris, Arthur Digby	C.E.	Hackensack, N. J.
Harris, Murray Duncan	E.M.	Marquette, Mich.
Harris, Myron Wilkins	Bus.	Newfield, N. J.
Hayes, Daniel Frank	E.E.	Paterson, N. J.
Heath, Donald Austin	E.M.	Jersey City, N. J.
Henry, Alvan LeRoy	Bus.	Flemington, N. J.
Henry, Gerald Boyd	B.A.	Buffalo, N. Y.
Hess, Harry Charles	Bus.	Massillon, Ohio
Hess, Howard Samuel, Jr.	Bus.	Hellertown
Hoffman, Kenneth Landes	E.M.	Uintondale
Holloway, Albert Marks	B.A.	Alden Station
Hood, George Washington, Jr.	Bus.	Weehawken, N. J.
Hornbaker, Donald Griffin	M.E.	Clarks Summit
Hubbard, Sheldon Crouter	E.M.	Palma Sola, Florida
Hunter, Joseph Eastham	B.A.	Jenkintown
Huyette, Samuel Louis	Bus.	Philadelphia
Jackson, Joseph Gray	Ch.E.	Bala-Cynwyd
Jaggard, LaBarre L.	Ch.E.	West Berlin, N. J.
Jedlicka, Frank Eugene	E.E.	Baltimore, Md.
Jennings, Albert Edwin	C.E.	Bethlehem
Jones, William J.	E.M.	Norbeth
Kear, Frank Gregg, Jr.	E.E.	Minersville
Keller, Charles Ferdinand	Ch.E.	Harrisburg
Kempf, Arthur William	B.A.	Bethlehem
Kiefer, Elmer Joseph, Jr.	M.E.	Stroudsburg
Kutz, Samuel Edward	M.E.	Easton
Laufer, Harry Edgar	Bus.	Bethlehem
Law, Hartland	Ch.E.	Camden, N. J.
Law, James Graham	Ch.E.	Bloomsburg
Ledoux, Leonard Knox	M.E.	Swarthmore
Lesh, Stogdell Stokes	E.E.	South River, N. J.
LeVan, James Henry	C.E.	Minersville
Lewin, Henry	Bus.	Malden, Mass.
Linck, Robert Charles	C.E.	Philadelphia
Lister, William Harry	M.E.	Rockville Centre, N. Y.
Loebell, Richard	Ch.E.	Malba, L. I., N. Y.
Long, George Davis	C.E.	Bolivar
Lucente, Romeo Julius	Bus.	Bethlehem

McCance, Edward Gilmour	B.A.	Bethlehem
McCormick, Neil James	B.A.	Bethlehem
McCullough, Walter Homer	C.E.	Vandergrift
McFarlan, Alden Irving	M.E.	Bayonne, N. J.
McGurl, Gilbert Vincent	Ch.E.	Minersville
McMorris, William Loring, Jr.	E.M.	Portsmouth, Va.
McWilliams, Charles Anthony Sinclair	Mar.E.	New York, N. Y.
Maiese, Domenick	E.E.	Camden, N. J.
Manuel, David Fuller	C.E.	Philadelphia
Mapes, Harold Edward	Bus.	Glen Ridge, N. J.
March, Robert Carl Richard	E.E.	Philadelphia
Mastriani, Samuel Gabriel	C.E.	Dunmore
Maxwell, John Walter, Jr.	Mar.E.	Philadelphia
Mellinger, Albert Charles	B.A.	Bethlehem
Merrill, Howard Elwood	B.A.	Garrett
Meurer, Louis George, Jr.	Bus.	Flushing, L. I., N. Y.
Meyers, Edgar Janvier	E.E.	Bridgeton, N. J.
Meyers, William Earl	Bus.	East Stroudsburg
Miller, Meyer Morton	E.M.	Baltimore, Md.
Miller, William James	Bus.	Bethlehem
Mong, Donald McMillan	E.E.	Erie
Moreland, Lester Duane	M.E.	Trenton, N. J.
Morris, James Reed	Bus.	Pittsburgh
Morris, Stanford Runyan	E.M.	Bristol
Morrison, James Robert Burnes	M.E.	Auburn
Murray, William Elmer, Jr.	M.E.	Louisville, Ky.
Nagle, George Samuel	E.E.	Abbottstown
Nicholas, Charles William	B.A.	Butler
Nicholls, Edward Samuel	Ch.E.	Bethlehem
Pakenham, Edward Dudley	B.A.	Brooklyn, N. Y.
Pease, George Warren	Bus.	Ridgewood, N. J.
Pease, Morris Gabriel	M.E.	Steelton
Perry, John Richard Pattison	E.E.	Centreville, Md.
Phyfe, Herbert Lloyd	C.E.	New York, N. Y.
Platt, Worthington Elmore	M.E.	New Haven, Conn.
Poliska, Stephen George	C.E.	Taylor
Pollack, Edward Wells	Bus.	New York, N. Y.
Presbrey, Clifton Hyde, Jr.	E.Ph.	Arlington, N. J.
Prior, Charles Malcolm	Bus.	Ridgewood, N. J.
Rankin, William Price	Ch.E.	Phoenixville

Rathbone, William Vinton	Ch.E.	Parkersburg, W. Va.
Rerig, Eugene Lyons	E.E.	Hazleton
Reynolds, Thomas Francis	M.E.	Bethlehem
Rice, Hugh Banker	C.E.	Roanoke, Va.
Rich, Herbert William	E.M.	West Orange, N. J.
Richman, Edwin, Jr.	E.E.	Haddon Heights, N. J.
Rigg, Edward Fletcher	Bus.	Burlington, N. J.
Roberts, John Eldon	Bus.	Buffalo, N. Y.
Robinson, Hugh Wilson	Bus.	Bethlehem
Robinson, Thomas Edmond	B.A.	Trenton, N. J.
Rupp, George Alvin	Bus.	Allentown
Sall, George Leonard	Bus.	Philadelphia
Sauerbrun, Irving Nelson	C.E.	Elizabeth, N. J.
Schmidt, John Henry	M.E.	Morristown, N. J.
Schmoyer, Paul William	Bus.	Allentown
Schneider, Robert Siis	M.E.	Richmond Hill, N. Y.
Scholly, Francis Roydon	B.A.	Bethlehem
Schroffel, John Bishop	M.E.	Camden, N. J.
Schuhle, Frank Frederick	Bus.	Brooklyn, N. Y.
Schwartz, Siegmund Philip, Jr.	E.E.	Bridgeport, Conn.
Schwimmer, Herman Victor	Bus.	Brooklyn, N. Y.
Scott, Wilson Winfield, Jr.	E.E.	Catasauqua
Scrivener, Samuel, Jr.	E.M.	Washington, D. C.
Seeley, Harold Morris	Bus.	Keansburg, N. J.
Serrell, Arthur Harold, Jr.	M.E.	Brooklyn, N. Y.
Shaheen, Philip Joseph	Bus.	Cranford, N. J.
Shartles, John H.	C.E.	Lancaster
Sheppard, Kenneth Anthony	C.E.	Bridgeton, N. J.
Shipley, Herbert Mapes	E.E.	Brooklyn, N. Y.
Shoup, Raymond Aurthur	E.E.	Reading
Shuhart, John Henry	E.E.	Bethlehem
Siebert, John Carl	Met.	Coopersburg
Smith, Douglas Malcolm	B.A.	Bethlehem
Smith, Frederick Calvin	B.A.	Pen Argyl
Smith, Gilbert Robert	E.E.	Jeddo
Spiehler, Augustus Mesh	Bus.	Rochester, N. Y.
Stauffer, Willis Keiter	M.E.	Bethlehem
Stein, Emil	B.A.	Bethlehem
Stevens, William Ronald	C.E.	Hackensack, N. J.
Stillman, Charles Allen, Jr.	Bus.	Akron, Ohio

Stofan, Andrew	B.A.	Eckley
Stofflet, Millard Abraham	B.A.	Nazareth
Strong, Alden Newkirk	B.A.	Philadelphia
Swank, Dallas Lester	E.M.	Binghamton, N. Y.
Swindells, William	C.E.	Portland, Ore.
Thorpe, Gardner Belknap	Bus.	Babylon, L. I., N. Y.
Trainer, Robert Leonard	C.E.	Irvington, N. J.
Travis, Frank Glen	Bus.	Bradentown, Fla.
Travis, John Thurston	B.A.	Paterson, N. J.
Varga, Vincent Ignatus	C.E.	Bethlehem
Vennel, Charles Reed	Bus.	Camden, N. J.
Visintainer, Alfred Alexander	C.E.	Mt. Carmel
Waesche, William Henry, Jr.	Bus.	Baltimore, Md.
Waldron, John Wesley	Ch.E.	Philadelphia
Walter, Carl Emil	C.E.	Baltimore, Md.
Walters, Emerson LeRoy	Bus.	Bethlehem
Washington, William deHertburn	E.E.	Riverton, N. J.
Watson, Charles Wilbur	E.E.	Madison, N. J.
Weaver, Russell Reiss	C.E.	Allentown
Weinstein, Benjamin	B.A.	Philadelphia
Wetzel, Roland Martz	M.E.	Bethlehem
White, Henry Brooks	E.M.	Philadelphia
Widdowfield, William Crippen	E.E.	Clark's Green
Williams, Laurence Augustine Peter	B.A.	Woodstock, Vermont
Williamson, Henry Thelbert	Bus.	Phillipsburg, N. J.
Wilmot, George Lincoln	E.M.	Hazleton
Winchester, Robert Caskey	B.A.	Phoenixville
Wintermute, Gerald Hiles	E.E.	Newton, N. J.
Zug, Charles Keller, Jr.	E.E.	Philadelphia
Zurn, Oliver Franklin	Ch.E.	Philadelphia

SOPHOMORE CLASS

Class of 1927

<i>Name</i>	<i>Curriculum</i>	<i>Residence</i>
Ake, Theodore	Met.	Canton, Ohio
Allen, John Bolling	C.E.	Washington, D. C.
Anderson, Frank George	E.E.	Takoma Park, D. C.
Andrew, Edmund Willard	B.A.	Bethlehem

Armstrong, William Walter	C.E.	Lisbon, Ohio
Arnold, Edwin Brown	B.A.	Zanesville, Ohio
Ash, Charles Elwood	M.E.	Kingston
Ashcraft, Edward Davis	E.E.	Millica Hill, N. J.
Askin, Joseph Samuel	Bus.	Brooklyn, N. Y.
Azpuruu, Fernando Capriles	C.E.	Puerto Cabello, Venez.
Baker, Ralph William	Ch.E.	Roanoke, Va.
Barba, Charles Elmer, Jr.	M.E.	Newton, Mass.
Barr, John Hope Sloan	M.E.	Wayne
Barrowclough, Kirk McCarter	C.E.	Chester
Bartoo, Elfred Garrett	C.E.	Ridgewood, N. J.
Beggs, George Harper	E.E.	Reading
Bester, Harold Fendrick	Bus.	Hagerstown, Md.
Birely, Frederick Adam	E.E.	New Oxford
Bittrich, Carl Louis	Met.	Bethlehem
Bloor, Ralph Loveland	M.E.	Trenton, N. J.
Borchers, Harry John	Bus.	Huntington, N. Y.
Bowler, Charles Wilbur	M.E.	Glenside
Brady, Charles Ignatus, Jr.	E.E.	Brooklyn, N. Y.
Brandon, Ford Campney	Met.	Beaver Falls
Brill, Fred Augustus, Jr.	Ch.E.	Swarthmore
Britton, Challis	E.E.	Scranton
Broad, Lambert Edward	B.A.	Nazareth
Broads, Irving	B.A.	Yonkers, N. Y.
Brookover, John Shartle	M.E.	E. Downingtown
Brooks, James Richard	Bus.	Miami, Fla.
Brown, Carlton Ernest	Ch.E.	Washington, D. C.
Brown, Charles Walker, Jr.	Ch.E.	Bethlehem
Brown, Harry Arthur	Ch.E.	Lebanon
Bush, Rudolph Myers	M.E.	Washington, D. C.
Butz, Richard James	Ch.E.	Allentown
Campbell, James Edward	Ch.E.	Oyster Bay, N. Y.
Canney, Arthur Warren	M.E.	Patterson, N. J.
Cannon, William, Jr.	Bus.	Bridgeville, Del.
Carmichael, Hilton Thomas	B.A.	New Haven, Conn.
Carns, William Boyden	B.A.	Philadelphia
Carogza, Frank Andrew	C.E.	Baltimore, Md.
Castor, Norman Richard	C.E.	Philadelphia
Chacey, Jouett Allen	Mar.E.	Paterson, N. J.
Chiodo, Leo Joseph	E.E.	Dunmore
Class, Charles Frank, Jr.	C.E.	Harrisburg

Cohen, Milton Harvey	B.A.	Lewistown
Cohen, Marcus Ovid	M.E.	Washington, D. C.
Comstock, Clinton Samuel	B.A.	Ridgewood, N. J.
Concilio, Vito Angelo	B.A.	Newton, N. J.
Constine, John Hart	B.A.	Wilkes-Barre
Cooke, Theodore, 3rd	Bus.	Pikesville, Md.
Coombe, William Thomas	Bus.	Bethlehem
Cooper, Frank Edwards	C.E.	Shamokin
Cooper, William Charles	C.E.	Shamokin
Cottrell, Joseph Donald	Ch.E.	Takoma Park, D. C.
Cox, John Philip	E.M.	Leonia, N. J.
Crawford, Frederick Rufus	B.A.	Pittsburgh
Cresswell, Herbert	M.E.	Scranton
Croxton, John Coventry	Bus.	Cleveland, Ohio
Cunningham, David Schreiber	E.M.	Ben Avon
Dancy, John Lloyd	E.E.	Phoenixville
DeGray, Richard John	Ch.E.	Ramsey, N. J.
DeLong, William Fox	E.E.	Philadelphia
DeMott, Howard Douglas	E.E.	Hackensack, N. J.
DeMoyer, John William, Jr.	C.E.	Camden, N. J.
Diener, John Bertram	M.E.	Hamburg
Dietrich, Noah Donald	Bus.	Bethlehem
Dixón, William Vincent	B.A.	Bethlehem
Doll, Frederick Tilghman	B.A.	Allentown
Doty, George Edward, Jr.	Bus.	Peekskill, N. Y.
Dwyer, William Francis, Jr.	E.E.	Easton
Easterbrook, William, Jr.	M.E.	Philadelphia
Eckstein, Mortimer Lazar	Bus.	Trenton, N. J.
Eisenbrown, Paul Daniel	E.E.	Reading
Elliott, J. Marshall	E.E.	Marcus Hook
Ellis, Franklin Griffith	B.A.	Allentown
Ely, Paul Coughanour	Met.	Monessen
Farrell, James Henry, Jr.	E.M.	Centralia
Feuerbach, William Ferdinand	Bus.	Richmond Hill, N. Y.
Fisher, Frederick Mertz	M.E.	Wyomissing
Fister, Harold John	Ch.E.	Allentown
Fluck, Robert William	E.E.	Allentown
Ford, John Simpson	E.M.	Denver, Colo.
Fountain, Robert Fielder, Jr.	Bus.	South River, N. J.
Frasca, Modestino John	B.A.	Stamford, Conn.
Frey, Julian Jordan	Bus.	Baltimore, Md.

Friebely, Carl Daniel	E.E.	Bethlehem
Fuller, Charles Rawson	B.A.	Flushing, N. Y.
Garcia, Emilio	M.E.	New York, N. Y.
Garrison, John Hazlett	M.E.	Pittsburgh
Gessner, Charles Booth	C.E.	Toledo, Ohio
Gibb, John Valentine	E.E.	Hadden Heights, N.J.
Gisriel, John Walter	Met.	Baltimore, Md.
Goodfellow, Owen Davis	M.E.	Coatesville
Gould, William	E.M.	Brooklyn, N. Y.
Gray, James Mitchell	Bus.	Middletown, N. Y.
Greenberg, David	B.A.	Bethlehem
Groven, Harold Bernard	Bus.	Piqua, Ohio
Grunwell, Gilbert Butterfield	C.E.	Punta Gorda, Fla.
Guerrero, Luis Francisco	E.M.	Columbia, S. A.
Gutowitz, Herman Joseph	B.A.	Amityville, N. Y.
Haas, Charles F.	E.E.	Sinaloa, Mexico
Hague, John Leopold	Bus.	Oradell, N. J.
Hamrah, Elias Alexander	Bus.	New York, N. Y.
Hanna, Charles Warren	M.E.	Cranford, N. J.
Harrier, Robert Austin	E.M.	LaCrosse, Wis.
Hartke, John Joseph, Jr.	C.E.	Elkridge, Md.
Hartnett, John Aloysius	E.E.	Dover, Del.
Harvey, Wilber Edward	Met.	Catasauqua
Hawkins, Wallace Randolph	C.E.	Gloucester, N. J.
Hayes, John Boniface	B.A.	New Britain, Conn.
Heaton, Percy Hugh	Ch.E.	Reading
Hebard, Robert Purdy	C.E.	New York, N. Y.
Heil, Clinton Franklin	B.A.	Bethlehem
Heine, Lawrence Joseph	E.E.	Bethlehem
Henke, Herman John	E.E.	Honesdale
Hertzler, John Rowe	M.E.	Lancaster
Hoffman, John Albert	C.E.	Fleetwood
Hoover, Dudley Allen	B.A.	Buffalo, N. Y.
Houseman, Kenneth Francis	M.E.	Plainfield, N. J.
Jewell, Nathaniel Farwell	Ch.E.	Olean, N. Y.
Johnson, James Dunlop	M.E.	Wingina, Va.
Jones, Hugh Clifford	Ch.E.	Wilkes-Barre
Jones, Ronald Emerson	E.M.	New Wilmington
Jones, Webster Sourber	B.A.	St. Clair
Jones, Walter Theodore	Bus.	Bath
Kear, Carl Irvin	M.E.	Minersville

Keen, Frank Porter	Bus.	Baltimore, Md.
Keller, Eugene Alvin	M.E.	Takoma Park, D. C.
Kemp, Theodore Halsey	E.E.	Glen Rock, N. J.
Kennedy, George Frederici	C.E.	Lansford
Kennedy, Richard Morris	E.E.	Lansford
Kent, Lewis Shaw	Bus.	Upper Montclair, N.J.
Kenworthy, William Bartle, Jr.	B.A.	Newark, N. J.
Ketterer, Paul Elmer	Bus.	Butler
King, Frederick William Forbes	M.E.	Glen Cove, N. Y.
Kinn, Edwin William	M.E.	Montclair, N. J.
Kirkwood, Thomas Alex	B.A.	West Pittston
Kittelberger, William Walton	Ch.E.	Curwensville
Kittinger, Irvine Johnston, Jr.	Bus.	Buffalo, N. Y.
Kitzinger, Stanley Arthur	B.A.	Yonkers, N. Y.
Kloman, Joseph Trapnell	B.A.	Salisbury, Md.
Knebels, John Henry	B.A.	Bethlehem
Knerr, Russell Peter	B.A.	Allentown
Knipe, Septimus Leon	C.E.	Bethlehem
Kost, Edward Paul	Met.	Torrington, Conn.
Krey, Norman Louis	Ch.E.	Washington, D. C.
Krone, Edward Louis	Bus.	Hackensack, N. J.
Kuck, George Justus	B.A.	Forest Hills, L. I., N. Y.
Lair, Walter B.	M.E.	Phillipsburg, N. J.
Lake, Edward Earl	Bus.	Perth Amboy, N. J.
Laudenbach, Herman Henry	E.E.	Nazareth
Lear, Caesar Clinton	Bus.	Bethlehem
Lee, Thomas Hung	M.E.	New York, N. Y.
Lee, Walter John	Bus.	Westfield, N. J.
Leidy, Lester Washington	E.E.	New Hanover
Lewis, Robert Beckwith	M.E.	Bethlehem
Light, John Dirks	B.A.	Lebanon
Liversidge, Preston Moore	Bus.	Cynwyd
Lobo, David	M.E.	Caracas, Venezuela
Long, Lewis Robert	Bus.	Bethlehem
Longo, Joseph Albert	B.A.	Bethlehem
Longstreet, Robert Louis	B.A.	Asbury Park, N. J.
Loomis, George Emerson	E.E.	Wilkes-Barre
Lovell, Frederick Harris	M.E.	Cranford, N. J.
Luria, Israel David	B.A.	Reading

MacFadden, Donald Schoon-		
maker	Bus.	Kingston, N. Y.
McCarty, Blaine Allen	B.A.	Pen Argyl
McCombs, Charles Edward	Bus.	Bethlehem
McCord, Herbert Weymouth	C.E.	Flushing, N. Y.
McKechnie, Edward	E.M.	Franklin, N. J.
Mackey, Theodore William	E.E.	Bethlehem
Maginniss, Hamilton John	M.E.	Philadelphia
Manner, Richard Jacob	E.E.	Bethlehem
Martin, William Edward, Jr.	Bus.	Bethlehem
Martindale, Harry Turner, Jr.	Bus.	Glen Ridge, N. J.
Marvin, Robert William	M.E.	Wyoming
Matheson, Kenneth Darragh	B.A.	Pittsburgh
Matson, Frederic Church	E.E.	Washington, D. C.
Medoff, Abraham David	Bus.	Philadelphia
Mercur, Frederic	B.A.	Roebling, N. J.
Metz, John Henry	E.E.	Scranton
Miles, Irving Beardsley	E.E.	Mount Vernon, N. Y.
Miller, Herbert Allison	B.A.	Huntingdon
Miller, Roger Light	C.E.	Lebanon
Mocclair, Joseph John	Bus.	New York, N. Y.
Molitor, Arthur Albert	Ch.E.	Swedesboro, N. J.
Mulert, Justus Louis	M.E.	Pittsburgh
Nagel, Charles Herbert	B.A.	Brooklyn, N. Y.
Nedewiski, Anthony Theodore	Chem.	Scranton
Nicholas, Joseph Anthony	E.E.	Dunmore
Nichols, John Hall	M.E.	Brooklyn, N. Y.
Nicholson, Charles Houston	Ch.E.	Bethlehem
Norbeck, Carl Frank	M.E.	LaCrosse, Wis.
Nutting, Harry Otis	E.M.	Lebanon
Olden, Joseph Bruere	C.E.	Princeton, N. J.
Olton, Frederick Hastings	Bus.	Philadelphia
Olwine, John Clayton	B.A.	Newark, N. J.
Ortlip, William Marshall	Ch.E.	Oxford
Osborn, Howard Milton	E.E.	Vineland, N. J.
Oswald, Edwin Miller	Ch.E.	Arlington, N. J.
Oswald, Ernest Paul	M.E.	Lancaster
Ottey, Earl Russel	E.M.	Marton
Ouss, Andrew A.	E.M.	New York, N. Y.
Passant, John Edward	M.E.	Chestnut Hill
Pennington, Carl Shaw	C.E.	Trenton, N. J.

Peterson, Bertel Neilson	C.E.	Philadelphia
Phillips, Arthur Harrison	E.E.	Reading
Phillips, Forrest E.	Ch.E.	Bethlehem
Picking, Jay Wilfred	E.E.	Somerset
Pierce, Ira Elford	E.E.	Peckville
Pitts, Reginald Shatswell	B.A.	Hanover
Poor, Benjamin Wood	E.E.	Glendale, Ohio
Pursel, Robert Newton	E.M.	Danville
Raine, Robert Newton	M.E.	Scranton
Rambler, Ralph Cassell	C.E.	West Hanover
Randles, Merritt Emmitt	B.A.	Ogdensburg, N. Y.
Reed, James Joseph	B.A.	Bethlehem
Reinsmith, Carlton Kline	C.E.	Emaus
Rexach, Jose Enrique	C.E.	New York, N. Y.
Richards, Robert Wardick	E.M.	Pittsburgh
Ridsdale, John Gordon	Ch.E.	Washington, D. C.
Riefe, James Henry, Jr.	E.E.	Baltimore, Md.
Rights, Herbert Theodore	E.E.	Bethlehem
Riskin, Milton Bernard	B.A.	Bethlehem
Roberts, Charles Wilson, Jr.	Bus.	Philadelphia
Robinson, Kenneth Irvin	M.E.	Millville, N. J.
Robinson, Thomas	Bus.	Hackensack, N. J.
Roderick, Rees Morgan	Ch.E.	Wilkes-Barre
Roe, James Baynard	B.A.	Sudlersville, Md.
Sample, Edgar Hoopes	E.E.	Bethlehem
Sampson, Henry Hazen	M.E.	Westfield, N. J.
Sarson, Harry Fowler	Bus.	East Orange, N. J.
Sasse, Louis Henry	E.E.	New York, N. Y.
Saxton, Robert Hibberd	Bus.	Richmond, Ind.
Scarlett, William John	M.E.	Erie
Schaffer, Walter Kenneth	Met.	Bethlehem
Schaub, Carl Martin	Met.	Freeland
Schaub, Earl Hartman	B.A.	Freeland
Schmalz, Frederick Willard	Bus.	Weehauken, N. J.
Schmertz, Edward Augustus	E.E.	Atlantic City, N. J.
Schmutz, George Henry	M.E.	Palmerton
Schoenfeldt, Hyman Robert	Ch.E.	Reading
Schoenly, Jackson Heiss	C.E.	Bethlehem
Scholl, Roy Franklin	B.A.	Bethlehem
Schwab, Edward Franklin	B.A.	Bath
Seaman, Stephen Francis	B.A.	Bethlehem

Seeman, Frederick Charles	E.M.	Baltimore, Md.
Shonk, Albert Davenport	Bus.	Kingston
Sinwell, Paul William	E.M.	Bethlehem
Smeltzer, Norman Harold	Bus.	Bellefonte
Smith, Cedric Leland	Bus.	Wakefield, Mass.
Snyder, Charles Samuel	E.E.	Northampton
Spalding, George	M.E.	Florence, Ala.
Sparks, Robert	E.E.	Far Rockaway, N. Y.
Spatz, Norman Samuel	E.E.	Bernville
Spillman, Emil Henry, Jr.	Met.	Allentown
Staab, Jerome James	E.E.	Reading
Staller, Alfred William	E.E.	Pottsville
Stephens, Fred James	E.M.	Franklin, N. J.
Stoddard, Elwood	E.E.	Bangor
Strohl, Paul Gogel	C.E.	Cementon
Symons, Ralph Hampton	C.E.	Johnstown
Thompson, William Andrew	B.A.	Brooklyn, N. Y.
Thornburg, Richard Beaumont	B.A.	Bethlehem
Tijerino, Cesar Dardanius	E.E.	Brooklyn, N. Y.
Toadvin, George Henry	B.A.	Williamsport
Trumbull, Albert Hanson	M.E.	New York, N. Y.
Tyler, Nathan Irving	Ch.E.	Ridgewood, N. Y.
Uebelhart, Donald Nichlous	Met.	Canton, Ohio
VanBilliard, Mitchell Walter	B.A.	Bethlehem
VanHorne, Roger Harold	Ch.E.	Germantown
Wagner, Charles Norton	E.E.	Allentown
Walborn, Charles Faust	C.E.	Wilkes-Barre
Warner, Lyman Darling	E.E.	Bryn Mawr
Wassell, Albert William	B.A.	Worcester, Mass.
Waters, Walter Brittain	B.A.	Newark, N. J.
Webster, Joseph Field	Mar.E.	Greenville
Welch, Merritt Ernest	E.E.	Bayonne, N. J.
Wenner, Roy Bruce, Jr.	C.E.	Philadelphia
Wertman, Paul Samuel	Met.	Palmerton
Weynberg, Bernard Lewis	B.A.	Brooklyn, N. Y.
Wilhelm, Frederic Harlan	Bus.	Bethlehem
Willis, Charles Ethelbert, Jr.	Met.	Richmond, Va.
Wilmurt, William Foster	Mar.E.	New Rochelle, N. Y.
Wilson, Lorenz Henry	M.E.	Swarthmore
Wilson, William VanZandt, Jr.	Bus.	Glen Ridge, N. J.
Wood, Thomas James	Met.	Palmerton

Woolley, John George Patrick	C.E.	Jenkindtown
Wright, Joseph Thomas	E.E.	Bethlehem
Yeager, James Roland	Bus.	Reading
Zimmermann, Eric Karl	Ch.E.	Passaic, N. J.

FRESHMAN CLASS

Class of 1928

<i>Name</i>	<i>Curriculum</i>	<i>Residence</i>
Abrom, Isidore	B.A.	Bethlehem
Adams, Ralph Harold	Bus.	Ellwood City.
Aitken, Donald Guthrie	E.E.	Orange, N. J.
Alden, Charles Whiting	Bus.	Steelton
Alexander David B.	B.A.	Allentown
Alexy, David Daniel Thomas	E.E.	Bethlehem
Allen, Edward Paul	M.E.	Saylesville, R. I.
Alter, Charles Sidney	E.E.	Pottsville
Althouse, Raymond Richard	C.E.	Philadelphia
Alwine, Harry Spangler	B.A.	Spring Grove
Ames, Charles Savage	B.A.	Scranton
Anderson, David Fleming	E.E.	Brooklyn, N. Y.
Andrade, Luis Flores	M.E.	Mexico City, Mexico
Autor, Hans Rudolph	Bus.	Bad Nauheim, Germany
Avery, Esmond John	Bus.	Minneapolis, Minn.
Bailey, Walter C., Jr.	Bus.	Germantown
Bair, James Alfred	E.E.	Swarthmore
Bambas, Stephen Walter	B.A.	Simpson
Barnitz, Edward Switzer	E.E.	Salem, Va.
Bass, Philip Hammer	Bus.	Brooklyn, N. Y.
Bauman, Paul Albert	Bus.	Danville
Baver, Clyde Byron	M.E.	Shoemakersville
Beaghen, Thomas Edmund	M.E.	Mount Vernon, N. Y.
Bean, Henry Sumner	E.E.	Woodbury, N. J.
Beans, John James	Bus.	Wheeling, W. Va.
Beauchamp, James Henry	Bus.	Bethlehem
Beck, John Emery	M.E.	Gary, Ind.
Beck, Robert Lewis	M.E.	Millville, N. J.
Becker, Stephen Pierce	Bus.	Poughkeepsie, N. Y.
Bender, Maurice Edwin	C.E.	Harrisburg
Bene, Frank	Ch.E.	Bethlehem

Bentz, John Mayo	E.E.	Montclair, N. J.
Berman, Ben Samuel	Bus.	Reading
Betterly, John Austin	C.E.	Scranton
Bevan, Thomas Wild	E.M.	Lawrence, Mass.
Biegel, Joseph Herman	B.A.	Brooklyn, N. Y.
Bieth, Chester Xavier	Bus.	Brooklyn, N. Y.
Billmeyer, William Brown, Jr.	B.A.	York
Bingle, Francis Xavier	Bus.	New York, N. Y.
Bittrich, Norbert Martin	B.A.	Bethlehem
Black, John Alfred	Bus.	Rockland, Maine
Bogerman, Frank Carter	Ch.E.	Paterson, N. J.
Bogert, William George, Jr.	M.E.	Allentown
Bolton, Jack Kemble	C.E.	York
Booker, William Patterson	E.E.	Portsmouth, O.
Boring, Robert Elliott	E.E.	Rutledge
Bortz, Harry Donald	Bus.	Allentown
Bossard, Frank Edgar	E.E.	Phillipsburg, N. J.
Boyle, Cornelius Francis	E.E.	Peely
Boyle, Garrett Joseph	E.E.	Plains
Bradford, Dean Whipple	E.E.	Nashville, Tenn.
Bradley, Jack Norton	C.E.	Port Washington, N.Y.
Brandon, James Elliott	Met.	New Cumberland, W.Va.
Brant, Thomas Wanamaker	M.E.	Norristown
Bricker, George Krall	E.E.	York
Browne, Martin Lawrence	B.A.	Brooklyn, N. Y.
Bruning, Louis Frank	M.E.	Greensburg
Brush, John Sivey	M.E.	Slatington
Buck, Charles A.	B.A.	Bethlehem
Buck, Walter Stephen	Bus.	Bethlehem
Burke, Donald Provan	B.A.	Philadelphia
Burke, Thomas Francis, Jr.	B.A.	West Pittston
Burkhart, Louis Hoddle	Bus.	Warren
Burlingame, Gordon M.	Bus.	Bryn Mawr
Butz, Henry Daniel	E.E.	Allentown
Byrnes, Russell	B.A.	Ardmore
Calder, William George	Met.	Dravosburg
Campbell, George Henry	Bus.	Beaver
Campbell, William	Ch.E.	Fullerton
Canning, Robert Ashton	C.E.	Bethlehem

Carlson, Carl Oscar	Bus.	Grantwood, N. J.
Carroll, Donald Francis	E.E.	Wilkes-Barre
Case, Samuel, Jr.	C.E.	Flemington, N. J.
Castle, Jesse Greenman	Bus.	Lockport, N. Y.
Cawley, Francis Ferris	B.A.	Archbald
Chamberlin, Richard MacMullen	E.M.	Harrisburg
Chickering, Kenton	Bus.	Oil City
Christman, Carl Mertz	C.E.	Reading
Cigol, Everett Colby	Bus.	Paterson, N. J.
Clarke, Davison Randolph	Ch.E.	Freemansburg
Clayton, Francis LeRoy	Bus.	Joplin, Mo.
Cleveland, George Thomas	B.A.	New London, Conn.
Clinger, Arthur William	Bus.	Oil City
Collins, Charles Frederick	Bus.	Bethlehem
Colver, William Henry, Jr.	M.E.	Speeceville
Conneen, John Kearney	B.A.	Maplewood, N. J.
Connell, Valentine Barker	E.E.	Audubon, N. J.
Connor, William Eugene	E.E.	Wilkes-Barre
Conrad, Harrison Whittingham	Bus.	New York, N. Y.
Coon, William Lewis	Bus.	Bridgeport, Conn.
Cornelius, Robert Comley	B.A.	McKeesport
Covert, John Addison	C.E.	Pittsburgh
Covey, John Knox	C.E.	Coudersport
Coxe, Thomas Herbert Carey	C.E.	Bethlehem
Craft, Edmund Coleman	Bus.	Pennington, N. J.
Cramer, Morgan Joseph	M.E.	New York, N. Y.
Crane, William Burdett, Jr.	Bus.	Kingston
Crawford, John Humphrey, Jr.	M.E.	Orange, N. J.
Creveling, John Ross	Bus.	Rahway, N. J.
Cron, Francis Lucius	Bus.	Piqua, Ohio
Culbertson, John Harrison	E.E.	Scranton
Curran, Robert Irving, Jr.	Bus.	Westfield, N. J.
Curtis, George Lawrence	Bus.	Cincinnati, N. Y.
Damiani, Philip Gerald	Bus.	Bethlehem
Daugherty, Joseph Michael	B.A.	McAdoo
Davis, Robert Rhodes	Bus.	Clarksburg, W. Va.
DeGroot, Lester Atkins	B.A.	Richmond Hill, N.Y.
DeHart, Russell Emerson	Bus.	Thorofare, N. J.
Deichler, Frank L., Jr.	C.E.	Upper Darby, Phila.
Delaplaine, Aubrey Cresson	C.E.	Cynwyd
Delmotte, Richard Wilson	B.A.	Harrisburg

Denise, John Robbins	C.E.	Oakmont
DeWolf, Ashley	M.E.	New York, N. Y.
Diener, Earl William	Ch.E.	Allentown
Difazio, Santo	B.A.	Brooklyn, N. Y.
Doehne, Robert	E.E.	Harrisburg
Donaldson, John Frazer	B.A.	Williamsport
Dorsey, William Herman	M.E.	New Britain, Conn.
Dotter, Harold Kleist	B.A.	Carlisle
Dougherty, John Webster, Jr.	B.A.	Bethlehem
Draper, William Corlett	Bus.	Toledo, Ohio
Dunn, William Hurley	C.E.	Park Ridge, N. J.
Eckhouse, Robert Horace	E.E.	Brooklyn, N. Y.
Edgar, Russell William	E.E.	Wilkes-Barre
Egleson, James Downey	M.E.	Ridley Park
Ellis, Ralph	C.E.	Ridgewood, N. J.
Ellis, Robert John	E.E.	Camden, N. J.
Emery, Walter Earl	E.E.	Mt. Bethel
Enscoe, George Stuart	C.E.	Port Washington, N. Y.
Evans, Robert Wells	E.E.	Cleveland, Ohio
Evans, William Esau	E.E.	Kingston
Evans, William Frisbie	B.A.	Glen Ridge, N. J.
Ewertz, Gordon Eric	E.E.	Elizabeth, N. J.
Fagin, Reubin R.	B.A.	Brooklyn, N. Y.
Fairchild, George Barnett	C.E.	Philadelphia
Farr, Jacob Donald	B.A.	Allentown
Fear, Robert Emmett	C.E.	Pittston
Fearnside, George Washington	C.E.	Bowling Green, Ohio
Feissner, Herman Herbert, Jr.	B.A.	Eckley
Fenstermacher, Guy Marvin	B.A.	Telford
Ferris, Irving Miester	B.A.	Westfield, N. J.
Feucht, Robert	E.E.	Uhlerstown
Fidler, Jay Reed	M.E.	Reading
Fine, Albert Hollister	C.E.	Alden Station
Finn, Irving Leonard	E.E.	Asbury Park, N. J.
First, John Yousling	Bus.	Carlisle
Fleming, Chapman Charles	Met.	Lakewood, Ohio
Flynn, Russell Edward	E.M.	Concord, Mass.
Forman, Maurice Richard	Bus.	Rochester, N. Y.
Foshay, Harry Nelson	B.A.	Peekskill, N. Y.
Fox, Charles Dyer	Bus.	Westfield, N. J.

Fox, Denton Edward	Ch.E.	Reading
Fraser, Alfred A.	B.A.	New York, N. Y.
French, Henry Nelson	E.E.	Stamford, Conn.
Friedlander, Arthur Isereal	M.E.	Hazleton
Fritzing, Alfred Randolph	E.E.	Slatington
Fulton, David Mercier	Bus.	Baltimore, Md.
Furnival, George Edward	C.E.	Philadelphia
Gaither, Walter Hugus, Jr.	Bus.	Harrisburg
Gardner, Evan Harris	C.E.	Bethlehem
Garre, Samuel, Jr.	C.E.	Ambler
Gee, Alden White	Bus.	Fall River, Mass.
Geisenderfer, Paul Frederick	C.E.	Bethlehem
German, Horace Bowne	B.A.	Ridgewood, N. J.
Getz, Benjamin Leo	Bus.	Allentown
Gilbert, DeWitt Cromwell	E.E.	Hackensack, N. J.
Gillham, Robert Paul	M.E.	St. Petersburg, Fla.
Gilmore, Paul George	B.A.	Williamsport
Giordano, Emilio	B.A.	New York, N. Y.
Giuffra, Stephen Anthony	B.A.	Towaco, N. J.
Gladstone, Maurice	B.A.	Allentown
Goepp, Ralph Max	M.E.	Philadelphia
Goldblatt, Nathaniel Rome	Ch.E.	Reading
Goodale, Walter Demig, Jr.	E.E.	East Orange, N. J.
Goodman, Milton	Bus.	Bethlehem
Goodman, Rubin B.	B.A.	Brooklyn, N. Y.
Gordon, Saul	B.A.	New York, N. Y.
Gould, Robert	C.E.	Brooklyn, N. Y.
Griffith, Charles Beall	M.E.	Washington, D. C.
Grimm, Joseph Lindell	E.E.	Collingswood, N. J.
Gualco, John George	Bus.	Mauch Chunk
Haigh, Douglass DeRosset, Jr.	C.E.	Cranford, N. J.
Hamilton, Andrew William, 3rd	E.E.	Bethlehem
Hand, Walter Merwyn	M.E.	Culver, Ind.
Hanf, Harry F.	B.A.	Jersey City, N. J.
Hang, Albert Adolph	E.E.	New York, N. Y.
Hansen, Henry Cornelius	E.M.	Brooklyn, N. Y.
Harris, Alfred Victor	M.E.	Pleasantville, N. Y.
Hartman, Roland Franklin	E.E.	Allentown
Hayward, Henry George	C.E.	Bridgeport, Conn.
Hazard, Robert Abbott	Bus.	Bethlehem
Heil, Wilbur Samuel	B.A.	Allentown

Heilman, William M.	B.A.	Kittanning
Heim, Kenneth Ethelbert	B.A.	Reading
Heller, Homer Kelsey	Bus.	Newark, N. J.
Helmstaedter, John William	Bus.	Newark, N. J.
Hengstenberg, Erie Wilkins	C.E.	Westwood, N. J.
Herwitz, Clarence	Bus.	Brooklyn, N. Y.
Heske, Paul Randolph	B.A.	Bethlehem
Hirschbach, Lawrence Henry	B.A.	Yonkers, N. Y.
Hoaster, Donald Jonas	Bus.	Lebanon
Hobbs, Herbert Clarence	C.E.	Brooklyn, N. Y.
Hoeke, William Warren	E.E.	Washington, D. C.
Hoffman, Kermit Bernecker	E.E.	Allentown
Holmes, John Middleton	Bus.	New York, N. Y.
Holtz, Jehiel	E.M.	Brooklyn, N. Y.
Hoover, Benjamin Wesley	B.A.	Sunbury
Hopkins, Zebulon Corbin	C.E.	Dover, Del.
Horner, Daniel Meade	M.E.	Oberlin
Horton, Leonard Mead	Bus.	Glen Ridge, N. J.
Hurley, Robert Richard	Bus.	Brooklyn, N. Y.
Hyland, Jack Wentworth	Bus.	Lansdowne
Isaacson, Carl	C.E.	Brooklyn, N. Y.
Jackson, Vernon E.	B.A.	Asbury Park, N.J.
Jaggard, Henry Brill	Bus.	West Berlin, N. J.
Jewell, Robert Burnett	C.E.	Winsted, Conn.
Johnson, Clifton Whatford	E.M.	New York, N. Y.
Johnson, Edward Leigh	M.E.	Wilmington, Del.
Jones, Raymond Benjamin	B.A.	Montclair, N. J.
Jones, Roland John	B.A.	Bath
Jordan, Lester Earl	C.E.	Allentown
Joyce, Walter Lee	B.A.	Newark, N. J.
Kanasut, Dien	M.E.	Washington, D. C.
K'Burg, Richard Bauman	Ch.E.	Forty Fort
Kelley, John Charles	Bus.	Harrisburg
Kellogg, John Mahon	E.M.	New York
Kerr, Edmund Begler	Bus.	Clearfield
Kesselman, Joseph Benjamin	B.A.	Brooklyn, N. Y.
Kessler, Arnold	B.A.	New York, N. Y.
Keyser, Cares Creighton	C.E.	Camden, N. J.
Kiep, Julian Anthony	E.E.	Joliet, Ill.
King, Paul Jones	Bus.	Allentown
Kise, Leroy Herman	Bus.	Allentown

Kleckner, William George	E.E.	Allentown
Knight, John Gibbons	Ch.E.	Easton
Koch, Paul Henry	M.E.	Macungie
Koehler, Carl J.	Ch.E.	Pleasantville, N. J.
Korsznoik, John	E.E.	Saugatuck, Conn.
Kosminsky, Jack Laurie	Bus.	Reading
Kramer, Henry	Bus.	Brooklyn, N. Y.
Kramer, Norman John	E.E.	Rutherford Heights
Kratz, Philip	Ch.E.	New Britain
Krause, Charles Kenneth	E.E.	Harrisburg
Kreidler, David Heilman	Bus.	Palmyra
Krevitt, Albert A.	B.A.	Brooklyn, N. Y.
Krick, Harold Theodore	E.M.	Hazleton
Kuchinski, Frank Edwin	M.E.	Minooka
Laedlein, William Augustus	M.E.	Williamsport
Lambert, Louis Edwin, Jr.	M.E.	Baltimore, Md.
Lang, Theodore Roosevelt	B.A.	Mt. Vernon, N. Y.
Larisch, Demeter	Bus.	Buffalo, N. Y.
Larsen, Andrew Gotfred	Bus.	Port Washington, N.Y.
Lasher, Wendell Lucas	M.E.	Morris Plains, N. J.
Laster, Jerome Benjamin	B.A.	Brooklyn, N. Y.
Laudenslager, Richard Loose	E.E.	Schwenksville
Laudig, John Benjamin	M.E.	Scranton
Laufer, Robert Milton	Bus.	Bethlehem
Laughlin, Albert Russell	E.E.	Bala-Cynwyd
Leader, Charles Carlton, Jr.	E.E.	Shamokin
Leister, Claude Merrill	B.A.	Bethlehem
Leive, Ralph	B.A.	New York, N. Y.
Lemay, John Wood	Bus.	Hollis, N. Y.
Lenna, Harry Albert	M.E.	Jamestown, N. Y.
Levin, Leon	B.A.	Trenton, N. J.
Levitz, Benjamin	Bus.	New York, N. Y.
Liever, Samuel	B.A.	Reading
Lindenmuth, Anson William	Ch.E.	Allentown
Littell, Isaac William, Jr.	Mar.E.	Staunton, Va.
Loekle, Harold Franklin	Bus.	Ridgewood, N. J.
Loeser, Albert Richard	Met.	Elizabeth, N. J.
Long, Fred Max	M.E.	Catawissa
Longacre, James Jacob	B.A.	Northampton
Lucas, Fred Cromer	E.E.	York

Lutz, John Adam, Jr.	M.E.	Myerstown
Lynch, Allen Clark	E.M.	Pitman, N. J.
Lynch, James Matthew	B.A.	Jersey City, N. J.
Lynn, George Randall	C.E.	Pottsville
Lyons, Max Arthur	B.A.	Forest City
McCarthy, Francis William	C.E.	St. Clair
McClarín, Robert Taylor	Ch.E.	Philadelphia
McDermott, Thomas Joseph	C.E.	Allentown
McGovern, Edward William	Ch.E.	Bethlehem
McIntosh, David, Jr.	Bus.	Tuxedo Park, N. Y.
McKinnon, Jack Webster	C.E.	York
Madenford, Donald Earl	M.E.	Pottsville
Magee, Charles Sloan	Bus.	Buffalo, N. Y.
Maher, Pierce Martin	C.E.	New Haven, Conn.
Majer, Curtis Eugene	E.E.	Allentown
Manley, John Howard	M.E.	Brooklyn, N. Y.
Marks, Theodore Everett	B.A.	Rome, N. Y.
Marshall, George Bertram, Jr.	Bus.	Larchmont, N. Y.
Martinez, Rodolfo Quintero	Ch.E.	Mexico City, Mexico
Martz, Chester Grant	Bus.	Harrisburg
Mastri, Dominic	Bus.	Scranton
Menendez, Joseph Feros	C.E.	Placetas, Cuba
Mercur, Henry	B.A.	Philadelphia
Messinger, Clyde Uhler	M.E.	Tatamy
Miller, Clarence H.	B.A.	Newburgh, N. Y.
Miller, Daniel George	E.E.	Spring Glen
Miller, Gilbert	B.A.	Bethlehem
Miller, John Howard Payne	E.M.	DuBois
Miller, Lawrence Winton	Bus.	Dayton, Ohio
Miller, Walter Lee	M.E.	Wernersville
Miller, William Crichton	Bus.	DuBois
Miller, William Edward, Jr.	Bus.	Baltimore, Md.
Mills, Lucius Nichols	Bus.	Newtown, Conn.
Mitchell, Daniel Patrick, Jr.	Bus.	Woodbury, N. J.
Moran, William M., II	Bus.	Glen Ridge, N. J.
Morrison, James Carlton	M.E.	Ithaca, N. Y.
Moyer, George Weldon	E.M.	Souderton
Mueller, Wesley William	M.E.	Newark, N. J.
Mullaney, Joseph Michael	B.A.	Concord, Mass.
Mumford, Carroll Norman	C.E.	Fairmont, W. Va.
Murray, James Bailey	E.E.	Phoenixville

Musser, William Edward	Bus.	Lewistown
Nauss, Morton Shultz	Bus.	Wrightsville
Nelson, Donald Charles	M.E.	Wyckoff, N. J.
Nevins, Samuel Lyle	B.A.	Hokendauqua
Newman, Robert Roy	E.M.	Bridgeport, Conn.
Niman, Morris Robert	Bus.	Brooklyn, N. Y.
Nitchie, Spencer Holmes	E.E.	Cranford, N. J.
Novick, David	B.A.	Easton
O'Callaghan, Eugene Francis	Bus.	Mamaroneck, N. Y.
O'Connell, John Charles	E.E.	Hagerstown, Md.
O'Neill, John DeBritto	C.E.	Allentown
O'Rourke, William Joseph	B.A.	Brooklyn, N. Y.
Orr, John McLane, Jr.	Bus.	Warren, Ohio
Oswald, John Randolph	M.E.	Catasauqua
Ott, Frank Wesley	Bus.	Bangor
Palm, Harry Wendel	C.E.	Bethlehem
Palm, William F.	B.A.	Bethlehem
Parker, Charles Harwood	Bus.	Greenwich, N. Y.
Parker, Howard Pope	B.A.	Washington, D. C.
Paschall, Edward Merrill	M.E.	Dauphin
Bayard		
Peloubet, Philip Henry	Bus.	Glen Ridge, N. J.
Pennock, John Sermon	E.E.	Cochanville
Phelps, Edward Stanley	E.E.	Rockville Centre, N. Y.
Phillips, Jule Edward, Jr.	M.E.	Trenton, N. J.
Pickel, Harry Adam, Jr.	Bus.	Lansford
Pierson, Theodore Gordon	E.E.	Washington, D. C.
Pitman, Walter Clarkson, Jr.	B.A.	Orange, N. J.
Plummer, James Harold	Bus.	Williamsport
Polhemus, James R.	Bus.	Bethlehem
Posey, James Byron	Bus.	Bethlehem
Purdy, Remington James	Bus.	Buffalo, N. Y.
Rader, Marlyn Asher	B.A.	Belfast
Raleigh, Walter Allen, Jr.	Bus.	Baltimore, Md.
Randall, David Anton	Bus.	Shamokin
Rankin, Frederick Voelker	Ch.E.	Wilkinsburg
Rapp, Haymond	Bus.	Clarksburg, W. Va.
Rappold, William Franklin	E.M.	Quakertown
Raskin, Morton H.	Bus.	Brooklyn, N. Y.

Raymond, Robert	B.A.	Brooklyn, N. Y.
Redline, Harold Samuel	B.A.	Bethlehem
Reese, Harold Roy	Bus.	Huntington, W. Va.
Reilly, Charles Edward	Bus.	Philadelphia
Remaley, Miles Edward	Bus.	Brooklyn, N. Y.
Rettino, Anthony Abel	B.A.	Jersey City, N. J.
Rice, Maxwell Jay	B.A.	Newark, N. J.
Riker, Herbert Adrian, Jr.	M.E.	Amityville, N. Y.
Riveiro, Ysolino Joaquin	C.E.	Cardenas, Cuba
Robbins, Hammitt Lake	E.E.	Port Norris, N. J.
Roberts, Charles Angelo	Bus.	Parkersburg, W. Va.
Roberts, Edwin Raphael	E.E.	St. Nicholas
Robinson, Malcolm Weeks	B.A.	Bethlehem
Roddy, Robert Edward Barnett	Ch.E.	Gloucester City, N.J.
Rosenson, Arthur	Bus.	Brooklyn, N. Y.
Ross, Donald Thornton	B.A.	Wilkes-Barre
Rubino, Joseph V.	B.A.	New York, N. Y.
Russell, Hiram Brooks	C.E.	Williamsport
Ryerson, Carl George Walter	E.E.	Tompkinsville, S. I., N. Y.
Sall, Manuel	B.A.	Philadelphia
Salomon, Herbert Frank	B.A.	New York, N. Y.
Sandwick, Charles Martin	B.A.	Elmira Heights, N.Y.
Schaeffer, Charles Albert	M.E.	Allentown
Schaffer, John Abraham	Bus.	Allentown
Schall, Theodore Torrence	Bus.	Bethlehem
Schmid, Frederick Christian, Jr.	E.E.	New York, N. Y.
Schrager, Henry	Bus.	Trenton, N. J.
Schreiner, Norman George	C.E.	Philadelphia
Schultz, Manuel	B.A.	New York, N. Y.
Schwartz, Frank Leroy	M.E.	Harrisburg
Schwarzstein, Milton	B.A.	Jersey City, N. J.
Searing, Arthur Fairchild	Bus.	Glen Ridge, N. J.
Seay, Henry Tilton	M.E.	Washington, D. C.
Sechrist, Walter Levere	E.E.	Dallastown
Secor, Andrew Reynolds	Ch.E.	Ossining, N. Y.
Sells, Judson Bowen	Bus.	Buffalo, N. Y.
Seltzer, David	Bus.	Atlantic City, N. J.
Sevart, George Gardner	E.E.	Allentown
Sheinfeld, Nathan Keva	B.A.	New Haven, Conn.
Shenton, Howard Francis	Ch.E.	Slatington

Shultz, Samuel Thompson	Ch.E.	Danville
Shurtleff, John Edgar	Bus.	Clarks Summit
Sickler, Richard Carl	E.M.	Wilkes-Barre
Sieminski, Henry, Jr.	M.E.	Jersey City, N. J.
Silberman, Samuel K.	M.E.	Lebanon
Simes, Gardner Merritt	Bus.	Brooklyn, N. Y.
Simpson, Charles Edward	B.A.	Norristown
Sinclair, Hugh Galt	Bus.	Akron, Ohio
Skakandy, Victor	E.E.	Nesquehoning
Smith, Allen Edwin	M.E.	Allendale, N. J.
Smith, Arthur Levern	Ch.E.	Coatesville
Smith, Gene Demestere	B.A.	Allentown
Smith, John Rawson	Bus.	Elmira, N. Y.
Smith, Lloyd Hilton	B.A.	Lansdowne
Snavely, Benjamin Lichty	E.E.	Lancaster
Sosa, Richardo	E.E.	Salta, Argentina
Sparacino, Peter Libero	B.A.	Brooklyn, N. Y.
Sparacino, Philip Rosalie		
Napoli	B.A.	Brooklyn. N. Y.
Speicher, George James	C.E.	Lebanon
Sprecher, James Leithiser	E.E.	Bethlehem
Springer, Kenneth Fred	Bus.	Brooklyn, N. Y.
Starkey, William Paul, Jr.	Bus.	Germantown
Stauffer, Charles Richard	Bus.	Bethlehem
Stay, Charles Albert	E.E.	Locust Valley, N. Y.
Steidle, William Jacob	B.A.	Jeddo
Steward, Joseph Edwin	B.A.	Shamokin
Stewart, George Cambreleng	C.E.	New York, N. Y.
Stieff, Forrest Samuel	Ch.E.	Reading
Stone, Franklin Porter	E.E.	Woodbury, N. J.
Stout, Benjamin Bassel	B.A.	Clarksburg, W. Va.
Stover, Raymond Shultz	Met.	Nazareth
Straub, Donald Benno	C.E.	Thornburg
Sudholz, Louis Henry	Ch.E.	Brooklyn, N. Y.
Sullivan, Neil Joseph	Bus.	Philadelphia
Swallow, Arthur Albert	E.E.	Bryn Mawr
Sweitzer, Albert James	M.E.	Brooklyn, N. Y.
Sweitzer, Raymond Wendell	E.E.	Philadelphia
Swinton, John	B.A.	Linden, N. J.
Talbert, Elmer Hughes	M.E.	Washington, D. C.
Talbot, John Ralph	Bus.	Fairmont, W. Va.

Taylor, Roger Schofield	E.E.	Philadelphia
Terry, Frederick Barnett	Bus.	Waynesboro
Thom, George Boyd	M.E.	Llanerch
Thomas, John Richardson	E.E.	Portsmouth, Ohio
Thum, Kurt William	B.A.	Newark, N. J.
Timen, Lawrence Sigmund	B.A.	New York, N. Y.
Timmons, Morris Massey	C.E.	Berlin, Md.
Tomlinson, Berrell Walton	B.A.	Philadelphia
Towle, Howard Colgate	E.E.	Woodbury, N. J.
Treat, Roger Lampport	Bus.	Newtown, Conn.
Trevaskis, Edward M.	B.A.	Denver, Colo.
Trumpore, George William	E.E.	Madison, N. J.
Tuggey, Charles David	B.A.	Bethlehem
Turner, Charles Franklin	B.A.	Wilkes-Barre
Turner, Mason Edward	E.M.	New York, N. Y.
Ullery, Richard Anderson	Met.	Thornburg
Ulmer, Louis Norman	Bus.	Pottsville
Ungerleider, Abraham	M.E.	Phillipsburg, N. J.
VanNort, John Lincoln	E.E.	Scranton
VanWinkle, Paul	Bus.	White Plains, N. Y.
Vaughan, Daniel Caraker	E.E.	Washington, D. C.
Vaughn, Stanley William	Mar.E.	Norwich, Conn.
Verrilli, Leonard Arthur	Ch.E.	Brooklyn, N. Y.
Vogel, Nathan Edward	B.A.	New York, N. Y.
Voorhies, Andre Francis	E.E.	Decatur, Ill.
Waaser, John Edward, Jr.	B.A.	East Mauch Chunk
Waesche, Charles Stewart	Bus.	Baltimore, Md.
Wagaman, James Mitchell	M.E.	Hagerstown, Md.
Wagner, Norman Warner	C.E.	Norristown
Walker, Fred Biesecker	B.A.	Somerset
Walker, Robert Woods	Ch.E.	Little Rock, Ark.
Walter, William	E.E.	Pine Grove
Waterman, John Anderson	M.E.	Gary, Ind.
Watkins, Edgar George	E.E.	Parsons
Weatherby, Joseph, Jr.	E.M.	Harrisburg
Weaver, Herbert Franklin, Jr.	Ch.E.	Bethlehem
Weaver, Paul Lawrence	Mar.E.	Dryden, N. Y.
Webber, John Dick, Jr.	Bus.	Bayonne, N. J.
Weiner, Louis	B.A.	Malden, Mass.
Weintraub, Herbert	Bus.	Atlantic City, N. J.
Werley, Edwin Penrose	Bus.	Allentown

Werley, Marvin Harold	M.E.	Allentown
Westbrook, Rodney Kenneth	B.A.	Towanda
Wetherill, Claude Scott	E.E.	Doylestown
Whaley, Frederick William	Bus.	Buffalo, N. Y.
White, Elmer John	B.A.	Ridgewood, N. J.
White, Frederick Crawford	Bus.	Punxsutawney
Whitney, Clarence Gilbert	C.E.	Camden, N. J.
Whitney, Reed	Mar.E.	Moylan
Wiegand, Ward Whitman	Bus.	Hollis Park Garden, S. I., N. Y.
Wiegner, James Robert	Ch.E.	Bethlehem
Wiley, William Gibson	E.E.	Philadelphia
Wilhelm, William Irving	E.E.	Harrisburg
Wilkinson, Charles Stewart	B.A.	Ben Avon
Williamson, John Thomas	B.A.	Niagara Falls, N. Y.
Williamson, Kenneth Seifert	C.E.	Shamokin
Willis, Francis Macleod	C.E.	Richmond, Va.
Wilson, Donald Robert	Bus.	Buffalo, N. Y.
Wilson, Warren Elvin	C.E.	Newark, N. J.
Wilt, Gerald Mumbauer	C.E.	Philadelphia
Winters, James Edward	Bus.	Jamestown, N. Y.
Wiseman, Gordon Churchill	Bus.	Washington, D. C.
Witt, Allen Arthur	Bus.	Montclair, N. J.
Wolfe, Samuel Melville, Jr.	B.A.	Wilkes-Barre
Wright, Craig LaSalle	Bus.	Hempstead, L. I., N. Y.
Wynn, William Andrew	Bus.	Orlando, Fla.
Yocum, Robert Curtis	M.E.	Shamokin
York, Vincent Charles	E.E.	Philadelphia
Young, Norman Spaulding	Ch.E.	Huntington, N. Y.
Zerbe, John Addison	Met.	Reading
Zerweck, Richard	E.E.	Bethlehem.

SPECIAL STUDENTS

<i>Name</i>	<i>Curriculum</i>	<i>Residence</i>
Bachman, Bertram Roden- baugh	Met.	Bethlehem
Brandt, Charles John	Bus.	Brooklyn, N. Y.
Fernandez, Carlos Alberto	E.M.	Argentina, S. A.
Frantz, Russell Herling	E.E.	Bethlehem
Horine, Adam Grove	Ch.E.	Philadelphia
Huaman, Filiberto	M.E.	Lima, Peru
Marr, William Makepeace	Bus.	Scranton
Miller, Harry Bachman	Bus.	Bethlehem
Miller, Ralph LeRoy	B.A.	Bethlehem
Ricapito, Joseph	B.A.	Bethlehem
Thomasson, Alred Posey	B.A.	Petersburg
Weise, Harold Oliver	B.A.	Queens, N. Y.

STUDENTS IN SATURDAY CLASSES, 1924-5

<i>Name</i>	<i>Residence</i>
DWYER, MARY M.	Bethlehem
ESPIRITU, SISTER	Easton
FATZINGER, ELSIE LOUISE	Bethlehem
RITA-ANGELA, SISTER	Bethlehem
SEIPLE, MIRIAM EVELYN	Easton
WORKMAN, DELLA DOROTHY	Buffalo, N. Y.

**STUDENTS IN THE EVENING SCHOOL OF
BUSINESS ADMINISTRATION**

<i>Name</i>	<i>Residence</i>
BALDREE, AARON BURR	Bethlehem
BECHTEL, LESTER A.	Allentown
BENDER, MERRITT ALBERT	Bethlehem
BIECHLER, CHARLES S.	Bethlehem
BISTRITZ, JOSEPH A.	Bethlehem
BOYER, WILLARD A. S.	Bethlehem
BRENNER, LAWRENCE MARTIN	Allentown
BROWN, KARL STANLEY	Allentown
BUECHELER, PAUL WILLIAM	Bethlehem
BURKHARDT, THEODORE L.	Bethlehem
CARNIHAN, WILLIAM D.	Bethlehem
CLARK, GEORGE	Bethlehem
CLEAVELAND, HORACE B.	Bethlehem

COFFIN, STANLEY NELSON	Bethlehem
COLLINS, JAMES LEONARD	Easton
CORNMAN, ELMER JOHN	Bethlehem
COTA, NORMAN D.	Bethlehem
CROSSAN, PAUL ELWOOD	Bethlehem
DANKEL, GEORGE W.	Bethlehem
DITTERLINE, ROY E.	Bethlehem
DRUMBOR, LEWIS D.	Bethlehem
DUNSTAN, HARRY R.	Bethlehem
EARLY, CHARLES JOHN	Bethlehem
EASTEN, JAMES	Bethlehem
ECKERT WARREN GRANVILLE	Hellertown
ENBERG, HENRY WINFIELD	Bethlehem
FACKENTHALL, HOMER J.	Bethlehem
FALK, ERIK RAGNAR	Bethlehem
FEEHRER, WILLIAM R.	Bethlehem
FORREST, GEORGE	Bethlehem
FREE, S. M.	Bethlehem
GILBERT, CHARLES WILLIAM	Catasauqua
GRANGER, JOHN	Bethlehem
GRUBE, ARNO FREDERICK	Bethlehem
GRUBE, WALLACE FRANCIS	Bethlehem
HAAS, MARSHALL B.	Bethlehem
HAGBERG, JOHN	Bethlehem
HAIN, ROBERT WILLIAM	Allentown
HARROP, JOHN D.	Allentown
HARTZELL, T. HAROLD	Bethlehem
HERSTINE, AUGUSTUS EDWARD	Bethlehem
HIGHFIELD, WILLIAM	Bethlehem
HIMMELWRIGHT, EARL	Bethlehem
HOTTLE, VINCENT STANLEY	Bethlehem
IHLE, FRED	Bethlehem
JACOBI, GEORGE A. C.	Bethlehem
KANE, PAUL L.	Bethlehem
KOENIG, WILLIAM	Bethlehem
KOONS, JOHN L.	Bethlehem
KRESGE, GEORGE M.	Bethlehem
LARSON, WOFFERD VICTOR	Bethlehem
LEIDICH, RAYMOND B.	Bethlehem
LUCAS, RALPH DILLINGER	Allentown
LUCENTE, PETER A.	Bethlehem

LUNDBECK, BERNT	Bethlehem
McELROY, WILLIAM GEORGE	Bethlehem
McLAY, THOMAS A.	Bethlehem
MACFARLANE, JOHN	Bethlehem
MARRYAT, DOUGLAS SCOTT	Bethlehem
NICEWONGEU, OLNEY W.	Bethlehem
NICHOLAS, ROBERT STERNER	Bethlehem
OTOSINA, JOHN C.	Bethlehem
PAULSEN, R.	Bethlehem
PENSKE, JULIUS HERMAN	Bethlehem
RAY, EDWARD LANGE	Bethlehem
REES, WILLIAM HENRY	Bethlehem
REICHARD, HAROLD BEUCHEN	Bethlehem
REIDER, FREEMAN W.	Allentown
REINER, WILLIAM GEORGE	Bethlehem
REYNOLDS, DOUGLAS P.	Bethlehem
RODEN, JULIAN C.	Bethlehem
ROSENBERGER, LEWIS H.	Bethlehem
ROYAL, G. BOYD, JR.	Bethlehem
SCHENIPFF, EDWARD C.	Allentown
SCHULER, NORMAN E.	Bethlehem
SCHWECHTEN, ROBERT JOHN	Bethlehem
SHERRY, PAUL STUART	Bethlehem
SMITH, FLORIAN JOSEPH	Allentown
SNYDER, ROBERT N.	Bethlehem
SOPER, ROBERT LITTLE	Bethlehem
SPRECHER, OLIVER B.	Bethlehem
STEWART, HARRY HUNT	Bethlehem
STRAWSNYDER, WARREN F.	Coopersburg
STROMAN, JOHN C.	Bethlehem
TASH, CLARENCE ANDREW	Bethlehem
TURNER, JAMES W.	Bethlehem
VANBILLIARD, CHARLES MELICK	Allentown
WALTERS, DAVID HARRIS	Bethlehem
WARREN, FREDERICK	Bethlehem
WEDDIGEN, RAYMOND L.	Bethlehem
WEIKEL, CHARLES H. H.	Bethlehem
WEISER, GRANT	Hellertown
WILDE, RALPH EDGAR	Bethlehem
WIMMER, HOWARD L.	Easton
WOODS, SAM	Allentown

SUMMER SESSION AT LEHIGH UNIVERSITY, 1924

<i>Name</i>	<i>Residence</i>
ABEL, DAVID HEATON	Ogontz
AKIALIS, JOSEPH MICHAEL	Newark, N. J.
ALLEN, CHARLES WESLEY	Reading
APPLEGATE, WILLIAM MCLEAN	Red Bank, N. J.
ASHCRAFT, EDWARD DAVIS	Mullica Hill, N. J.
AZPURUA, FERNANDO CAPRILES	Puerto Cabello, Venez.
BACHMAN, GEORGE, JR.	Camden, N. J.
BARNES, JOHN FRANCIS	Bethlehem
BATZ, KENNETH WILLIAM YATES	Stapleton, N. Y.
BECKMAN, GEORGE WILLIAM	Hellertown
BENE, FRANK	Bethlehem
BERGEN, LEWIS SPADER	Matawan, N. J.
BINAL, RONG	Washington, D. C.
BLAKE, ALFRED GREENE	Pittsburgh
BOND, LOUIS BOUTELL	Philadelphia
BONTZ, NAOMI	Allentown
BORTZ, RUTH WIEDER	Allentown
BRENNECKE, FRANCES ELIZABETH	Bethlehem
BROWN, CHARLES WALKER, JR.	Bethlehem
BROWN, LEROY AUGUSTUS	Allentown
BROWN, WILLARD MARSHALL	Palmerton
BUCK, RICHARD JOSEPH	Bethlehem
BUELL, DAVID CLINTON, JR.	Midletown, N. Y.
BURGESS, HENRY RUSSELL	Pittsburgh
BUSHAR, HAROLD GORDON	Pottsville
BUSS, EVELYN ESTHER	Bethlehem
BUSS, REBECCA ELLA	Bethlehem
CALLOW, MICHAEL JOHN	New York, N. Y.
CAMPBELL, JAMES EDWARD	Oyster Bay, N. Y.
CASTLEMAN, FRANCIS LEE, JR.	Philadelphia
CASTOR, NORMAN RICHARD	Philadelphia
CETINA, RENAN	Campeche, Mexico
CHACEY, JOUETT ALLEN	Paterson, N. J.
CHAMBERS, HAROLD BAIR	Lancaster
COHEN, MILFORD HERSH	Charlestown, W. Va.
COOPER, FRANK EDWARD	Shamokin
COTTMAN, LEWELLYN POWELL	Baltimore, Md.
COTTMAN, WILLIAM WATSON, JR.	New Hope

COX, JOHN PHILIP	Leonia, N. J.
CRAIG, JOHN HORNER	Slatington
CRAWFORD, FREDERICK RUFUS	Pittsburgh
CROLL, JOHN HAROLD	Steeltown
CUMMING, BENJAMIN WILSON	Pottsville
CUNNINGHAM, DAVID	Ben Avon
DANKO, JOHN VINCENT	E. Post Chester, Conn.
DAVIS, RICHARD LIGHT	Lebanon
DINKEY, CHARLES EUGENE	Pittsburgh
DORTON, FREDERICK BABCOCK	Baltimore, Md.
DRUCKENMILLER, MYRA	Emaus
DUBOIS, ALLEN CORSON	Clayton
DUDLEY, THOMAS UNDERWOOD, JR.	Middleburg, Va.
DWYER, WILLIAM FRANCIS, JR.	Easton
DWYER, MARY MARGARET	Bethlehem
DYSON, ROBERT HARRIS	Washington, D. C.
EDSON, WARREN NEWTON	Scranton
EGOLF, HARRY LOUIS, JR.	Philadelphia
ELLIOTT, LEWIS CHARLES	York
ENTREKIN, PAUL BRINTON	Swarthmore
EVANS, MERLE ALBERT	Ebensburg
EVERHART, JOHN LAURENCE	Bethlehem
EWART, ROSWELL HORR	Plainfield, N. J.
FEAR, ROBERT EMMETT	Pittston
FEHR, HOWARD FRANKLIN	Bethlehem
FRICK, RUFUS ALBERT	Kutztown
FERNANDEZ, CHARLES ALBERT	Buenos Aires, Argentina
FINADY, W. A. (MRS.)	Bethlehem
FISTER, HAROLD JOHN	Allentown
FITCH, CHARLES PERKINS	Asbury Park, N. J.
FORT, GEORGE LAFAYETTE	Minneapolis, Minn.
FRAIVILLIG, LEONARD MARTIN	Bethlehem
FRANTZ, RUSSELL HERLING	Catasauqua
FRAUENHEIM, RICHARD JOSEPH	Pittsburgh
FREY, FRANK GUSTAVE, JR.	Baltimore, Md.
GARCIA, EMILIO	New York, N. Y.
GEHO, CHARLES HENRY	Allentown
GILES, EDWARD MAYNARD	Paterson, N. J.
GLENN, GRAEFF WILLIAM	Elkins Park

GODSHALK, GERALD DESMOND	Lansdale
GONDOS, ROBERT ZOLTAN	Philadelphia
GORDON, MALCOLM KENNETH, JR.	New York, N. Y.
GOULD, WILLIAM	Brooklyn, N. Y.
GRIESEMER, DAVID ELIAS	Allentown
GUERRERO, LOUIS FRANCISCO	Columbia, S. A.
HALTEMAN, AUSTIN SHAFFER	Allentown
HARRIER, ROBERT AUSTIN	LaCrosse, Wis.
HARRIS, ABRAHAM BUCKLEY	Baltimore, Md.
HARRIS, ARTHUR DIGBY	Hackensack, N. J.
HARRIS, MURRAY DUNCAN	Marquette, Mich.
HARTKE, JOHN JOSEPH, JR.	Elkridge, Md.
HEATH, DONALD AUSTIN	Jersey City, N. J.
HEIMBROOK, CHARLES ALBERT	Bethlehem
HENKE, HERMAN JOHN	Honesdale
HEWSON, EDWARD HASKELL	Madison, N. J.
HIGGINBOTTOM, WILLIAM ERIC	Baltimore, Md.
HOFFMAN, JOHN ALBERT	Fleetwood
HOFFMAN, KENNETH LANDERS	Vintondale
HUAMAN, FILIBERTO	Lima, Peru
INGOLS, HEBER ASHE	Newark, N. J.
JACKSON, JOSEPH GRAY	Bala-Cynwyd
JAMES, BERTHA EDWARDS	Bethlehem
JAMES, J. EDWARD (MRS.)	Bethlehem
JEDLICKA, FRANK EUGENE	Baltimore, Md.
JENNINGS, ALBERT EDWARD	Bethlehem
JEWELL, NATHANIEL FARWELL	Olean, N. Y.
KANASUT, DIEN	Washington, D. C.
KASPER, RALPH JOSEPH	Ridgefield, Conn.
KELLER, CHARLES FERDINAND	Harrisburg
KEMPF, ARTHUR WILLIAM	Bethlehem
KENSING, ALFRED KENNETH	New York, N. Y.
KERR, HARRY KNIGHT	Philadelphia
KESSLER, HOWARD, (MRS.)	Nazareth
KIRCHNER, EARL LORENZ	Washington, D. C.
KNIPE, SEPTIMUS LEON	Bethlehem
LAMBERT, RALPH ARTHUR	Bethlehem
LANG, ELHEIM	Phoenixville
LANGFITT, JAMES PORTER	Parkersburg, W. Va.
LARAMY, WILLIAM JOHN	Altoona

LAUDENBACH, HERMAN HENRY	Nazareth
LAW, HARTLAND	Camden, N. J.
LAWALL, PAUL	Catasauqua
LEE, RUSSELL WERNER	Ottawa, Ill.
LEE, WALTER JOHN, JR.	Westfield, N. J.
LEVAN, JAMES HENRY	Minersville
LEVY, MAURICE BERT	Hazleton
LINCK, ROBERT CHARLES	Philadelphia
LITTELL, ISAAC WILLIAM	Annapolis, Md.
LOBO, DAVID	New York, N. Y.
LOEBELL, RICHARD E.	Whitestone, N. Y.
LONG, GEORGE DAVIS	Bolivar
LONGSTREET, ROBERT LOUIS	Asbury Park, N. J.
LOVELL, FREDERICK HARRIS	Cranford, N. J.
LUDWIG, EDWARD HENRY	Tomkinsville, N. Y.
LURIA, ISRAEL DAVID	Reading
MACFATE, ROBERT PRESTON	Bethlehem
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ZERWECK, RICHARD	Bethlehem
ZURN, OLIVER FRANKLIN	Philadelphia

**SUMMER SESSION AT THE TRAINING SCHOOL OF
VINELAND, NEW JERSEY, 1924**

<i>Name</i>	<i>Residence</i>
ATKINSON, FRANCES E.	Ventnor, N. J.
BONSALL, CAROLYN W.	Coatesville
CLEMENS, ROBERT	Hazleton
COOK, ILA	Coytesville
CORBIN, EVA M.	Warren
DECKARD, HULDAH M.	Erie
FINNIMORE, M. ALYS	Montclair, N. J.
GILFILLAN, MRS. W. J.	Memphis, Tenn.
GRAY, DOROTHY E.	Hastings-on-Hudson, New York
HALL, MAUDE	Crawfordsville
HALFAST, HELEN LOUISE	Erie
HARVEY, MRS. O. R.	Columbus, Ga.
HASICK, ETTA P.	Freedom
HAWKS, MRS. VERA	Erie
HEEFNER, CATHERINE	Harrisburg
HUDSON, MRS. ELEANOR D.	Curry
KNIGHT, MAUDE	Kingston, N. C.
LAMBERT, MRS. BEULAH	Bethlehem
MCGILL, LORETTA B.	Waterbury, Conn.
MCCOY, ELEANOR	Sharon
MCLAUGHLIN, LILLIAN, MRS.	Erie
NOWICKE, EVE	Paterson, N. J.
O'HARA, ALICE E.	Milwaukee, Wis.
PHILLIPS, ORA E.	Terre Haute, Ind.

PHILLIPS, ZOE M.
PRICE, L. MARION
QUIMBY, IDA T.
RASTATTER, GERTRUDE M.
SHEARER, ELSIE A.
SICKLES, EDNA L. M.
SMITH, ISABELLE L.
STEWART, CAROLINE E.
VAVALO, JOHN B.
WEDEKING, LORENA P.
WILSON, VERNICE
ZENTZ, MABEL

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Toronto, Canada
New Bedford, Mass.
Erie
Trenton, N. J.
Newark, N. J.
Los Angeles, Calif.
Baltimore, Md.
Erie
Evansville, Ind.
Albany, N. Y.
Omaha, Nebr.

SUMMARY OF STUDENTS BY CLASSES AND CURRICULA

Curricula	Seniors	Juniors	Sophomores	Freshmen	Specials	Totals
Arts and Sci.	33	30	55	112	4	234
Bus. Adm.	40	53	47	135	3	278
Civil Eng.	25	28	33	57	..	143
Mech. Eng.	30	31	44	60	1	166
Metallurgy	6	2	14	7	1	30
Mining Eng.	20	20	17	16	1	74
Elect. Eng.	23	36	52	85	1	197
Chemistry	2	3	1	.....	..	6
Chem. Eng.	36	18	26	28	1	109
Marine Eng.	4	3	3	4	..	14
Eng. Physics	1	3	....	.....	..	4
B.A. Eng.	4	....	....	.....	..	4
TOTALS	224	227	292	504	12	1259
Graduate Students						43
Students in Saturday Classes (undergraduates)						6
Students in the Evening School of Business						
Administration						95
Summer Session, 1924:						
At the University						246
At the Training School of Vineland, N J.						36
TOTAL						1685

GEOGRAPHICAL DISTRIBUTION OF STUDENTS
(Undergraduates)
1924-5

	Seniors	Juniors	Sophomores	Freshmen	Specials	Totals
Alabama .....	.....	.....	1	.....	.....	1
Arkansas	1	.....	.....	1	.....	2
Colorado .....	.....	.....	1	1	.....	2
Connecticut	4	2	4	13	.....	23
Delaware	1	.....	2	2	.....	5
District of Columbia	4	3	10	9	.....	26
Florida .....	.....	2	2	2	.....	6
Illinois	2	.....	.....	2	.....	4
Indiana .....	.....	.....	1	3	.....	4
Kentucky .....	.....	1	.....	.....	.....	1
Maine .....	.....	.....	.....	1	.....	1
Maryland	8	7	11	8	.....	34
Massachusetts	2	1	3	5	.....	11
Michigan	2	1	.....	.....	.....	3
Minnesota .....	.....	.....	.....	1	.....	1
Missouri .....	.....	1	.....	1	.....	2
New Jersey	48	55	49	77	.....	229
New York	18	24	37	98	2	179
Ohio	2	3	8	10	.....	23
Oregon	1	1	.....	.....	.....	2
Pennsylvania	121	120	154	250	8	653
Rhode Island .....	.....	.....	.....	1	.....	1
South Carolina	1	.....	.....	.....	.....	1
Tennessee	1	.....	.....	1	.....	2
Vermont .....	.....	1	.....	.....	.....	1
Virginia	2	3	3	3	.....	11
West Virginia	4	1	.....	9	.....	14
Wisconsin .....	.....	.....	2	.....	.....	2

Argentina

Republic .....	.....	.....	.....	1	1	2
China	1	.....	.....	.....	.....	1
Colombia .....	.....	.....	1	.....	.....	1
Cuba .....	.....	.....	.....	2	.....	2
Germany				1		1
Mexico		1	1	2		4
Peru					1	1
Venezuela	1		2			3
TOTALS	224	227	292	504	12	1259

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TIMES PUBLISHING COMPANY
BETHLEHEM, PA.